

CHAPTER 3

Alternatives

BACKGROUND AND ALTERNATIVES DEVELOPMENT AND SCREENING

PURPOSE OF THE CHAPTER

Information in the chapter is presented to provide the reader an understanding of steps taken to identify those alternatives ultimately studied in detail in the Final Environmental Impact Statement (FEIS). Table 3-1 provides a summary of topics, content, and intended benefits to the reader.

CONTEXT OF ALTERNATIVES IN THE EIS PROCESS

After a purpose and need has been established for the proposed action (see Chapter 1, *Purpose and Need*), a key step in the environmental impact statement (EIS) process is to identify a range of reasonable alternatives to be studied in detail in the FEIS (see sidebar, on this page, regarding the definition of a range of reasonable alternatives). This step is commonly referred to as an alternatives development and screening process. Its purpose is to identify reasonable alternatives to the proposed action to allow for meaningful subsequent comparison of how these alternatives may affect the human and natural environment (described in Chapter 4, *Affected Environment, Environmental Consequences, and Mitigation*).

ALTERNATIVES DEVELOPMENT AND SCREENING

Alternatives for a major transportation facility in the Study Area have been proposed and studied since the mid-1980s. Those proposals were not discarded,

but rather were incorporated into the consideration, development, and study of alternatives for the EIS process, which began in 2002 following the clear determination of a purpose and need for the proposed action. Figure 3-1 illustrates the relationship of the Study Area for the proposed action to other transportation facilities and some of the communities in the region it would serve. Beginning with the initial agency and public scoping efforts, numerous alternatives were considered to determine the most appropriate transportation investment strategy. Alternatives considered included past freeway proposals as well as transportation system management (TSM)/transportation demand management (TDM), transit (e.g., commuter rail, light rail, expanded bus services), arterial street network improvements, land use controls, new freeways, and a No-Action Alternative.

Alternatives Development and Screening Process

The following text describes the process used to identify, develop, and screen action alternatives, concluding with identification of the action alternatives to be studied in detail in the FEIS. The screening process is summarized to facilitate readers' understanding of the process and of the logic for actions taken by the project team (see sidebar on this page for a description of project team). More detail can be found in the *Validation of the Alternatives Screening Process at the FEIS Stage* (2014) (see sidebars on page 3-2).

Reconfirm the Purpose and Need for the Proposed Action

The first step in the alternatives development and screening process was to reconfirm the purpose and need for the proposed action, as presented in Chapter 1. In June 2013, the Maricopa Association of Governments (MAG) approved new socioeconomic projections for Maricopa County. The purpose and need analysis was updated and reevaluated using these new population, employment, and housing projections and corresponding projections related to regional traffic. The conclusions reached in the Draft Environmental Impact Statement (DEIS) were reconfirmed in the FEIS. The analysis described in Chapter 1, *Purpose and Need*, concluded a major transportation facility is needed in the Study Area to address increases in population, housing, and employment projected in the MAG region over the next 20-plus years. These socioeconomic factors are expected to increase steadily through 2035, and vehicle miles traveled (VMT) are expected to grow from 91 million to 147 million over the same period. Much of this growth will occur in areas that would be served by a major transportation facility in the Study Area. A major transportation facility is also needed to address projected increases in regional transportation demand and deficiencies in transportation system capacity. Although capacity deficiencies exist today, they are expected to worsen and cause even greater increases in travel times (delays) by 2035.

What is meant by a range of reasonable alternatives?

Federal regulations stipulate that an EIS shall "rigorously explore and objectively evaluate all reasonable alternatives" (40 Code of Federal Regulations § 1502.14). In 1983, the Council on Environmental Quality issued guidance stating "reasonable alternatives include those that are practical or feasible from a technical and economic standpoint" and "us[e] common sense." When a large number of alternatives may exist, "only a reasonable number . . . covering the full spectrum of alternatives, must be analyzed and compared in the EIS" (*Federal Register* 46:18026 [1981]).

Who is the project team?

The project team is a group of individuals who represent a comprehensive set of diverse viewpoints and have expertise relevant to environmental concerns, design requirements, traffic optimization goals, project costs, and concerns of local importance. The team includes local jurisdictions and federal, State, and regional agencies. (See Chapter 6, *Comments and Coordination*, for a list of project team members.)

Review of technical reports, predecisional reports, and memorandums

Technical reports—with the exception of the cultural resources and Section 4(f) technical reports (because of the sensitive information they contain)—are available on the project Web site at <azdot.gov/southmountainfreeway>. If reviewing a hard copy, the technical reports are also included on the compact disc placed in the envelope on the back cover of Volume I. Technical reports, predecisional reports, and memorandums can be made available for review by appointment at ADOT Environmental Planning Group, 1611 W. Jackson St., Phoenix, AZ 85007 [(602) 712-7767]. Special requests for portions of the cultural resources and Section 4(f) reports will be considered by ADOT on a case-by-case basis. These reports examine existing conditions and assess potential impacts on existing conditions.

Validation of the Alternatives Screening Process at the FEIS Stage

The screening process for the project, which began in 2001, included many stages and was updated and validated over a 13-year period. Over that time, change has occurred in the Study Area and region, which includes all of the Phoenix metropolitan area. Additionally, after the DEIS release, MAG approved new socioeconomic and traffic projections for the region. In response, the project team reviewed and validated the screening process, as documented in the *Validation of the Alternatives Screening Process at the FEIS Stage* memorandum (see sidebar on this page for information on how to review the memorandum). Within each step of the process the consensus points are identified along with reference to the original documentation or study that supports the screening process and validation of the analysis presented in the original documentation.

Table 3-1 Alternatives Content Summary, Chapter 3

Topic	Page	Highlights	Reader Benefit
Purpose of the Chapter	3-1	<ul style="list-style-type: none"> Context of alternatives in the EIS^a process 	<ul style="list-style-type: none"> An understanding of the definition of a full range of reasonable alternatives and how they are assessed in the FEIS^b
Alternatives Development and Screening	3-1	<ul style="list-style-type: none"> Alternative development and screening process overview Development of screening criteria Modal screening Modes eliminated from further study Corridor screening Corridors eliminated from further study Alignment alternatives screening (First Tier) Alignments eliminated from further study Creation of Western and Eastern Sections in the proposed action's Study Area Technical alternatives screening (Second Tier) Technical alternatives eliminated from further study Design options and refinements (Third Tier) Design options eliminated from further study Design adjustments (Fourth Tier) Design alternatives and footprint and alignment options eliminated from further study Alignment screening and further design adjustments (Fifth Tier) Alignment on Community^c land and alignment option eliminated from further study Responsiveness of proposed freeway to purpose and need criteria Additional benefits of the proposed freeway Summary of screening process 	<ul style="list-style-type: none"> Orientation to the geography of the Study Area Orientation to how alternatives and their environmental effects are presented in the FEIS An understanding of how alternatives for the proposed action were developed, who (including the public) contributed to the development of alternatives, and what alternatives were considered An understanding of the logical, sequential steps taken—and by whom—to determine which alternatives should be studied in detail in the FEIS An understanding of why multiple disciplines, or factors, are considered when comparing alternatives An understanding of why—individually—transit, rail, and other nonfreeway alternatives are not studied in detail in the FEIS An understanding of logical termini and independent utility, regardless of alternative considered An understanding of why some freeway alternatives were eliminated from detailed study in the FEIS An understanding of adjustments made to alternatives to further reduce impacts before detailed study was undertaken An understanding of beneficial outcomes related to the screening of alternatives Identification of the action alternatives to be studied in detail in the FEIS Introduction to the degree of regulatory interaction required for the proposed action An understanding of why a freeway alternative would meet the purpose and need criteria of the project
Alternatives Studied in Detail	3-40	<ul style="list-style-type: none"> No-Action Alternative Descriptions of the action alternatives Traffic operations of the alternatives 	<ul style="list-style-type: none"> A description of the No-Action Alternative and why it is studied An understanding of design features of each action alternative, including alignment, profile, number of lanes, and ancillary design features An understanding of conceptual costs and construction sequencing for each action alternative An understanding of enhancement opportunities associated with the action alternatives An understanding of how traffic would operate on each alternative in the future
Identification of a Preferred Alternative	3-62	<ul style="list-style-type: none"> Process and reasons for the identification of the Preferred Alternatives in the Western and Eastern Sections 	<ul style="list-style-type: none"> Awareness of the Preferred Alternatives in the Western and Eastern Sections An understanding that the identification of a Preferred Alternative is not final until the EIS process is complete An understanding of ongoing coordination with the Community
Conclusions	3-70	<ul style="list-style-type: none"> Summary of alternatives in the EIS process 	<ul style="list-style-type: none"> A summary of the process to screen alternatives, identify a range of reasonable alternatives, study alternatives in detail, and identify a Preferred Alternative

^a environmental impact statement ^b Final Environmental Impact Statement ^c Gila River Indian Community

The purpose of the proposed action—a major transportation facility—is to address the transportation needs described above. Constructing and operating such a facility may serve other purposes as well, including:

- ▶ providing regional transportation system linkage as planned in the *Regional Transportation Plan* (RTP)
- ▶ serving regional mobility needs (moving trips from lower-capacity to higher-capacity facilities)
- ▶ meeting objectives adopted in regional and local long-range plans

These additional purposes of the proposed action are discussed in this chapter and in the *Land Use* section of Chapter 4, beginning on page 4-3.

Alternatives Development and Screening Process Described

A process was undertaken to develop a range of alternatives, screen those alternatives using a multidisciplinary set of criteria (see sidebar on the next page), and identify the alternatives to be studied in detail in the FEIS. Figure 3-2 schematically illustrates the process undertaken.

To define the process, a memorandum (*Alternatives Development and Screening Process Memorandum* [2002], see sidebar on page 3-2) was first created. The project team concurred with the approach outlined in the memorandum, specifically:

- ▶ The approach outlined would satisfy National Environmental Policy Act (NEPA) intent, Federal Highway Administration (FHWA) guidelines that implement NEPA, ADOT environmental policy, and related environmental policies and regulations.
- ▶ The criteria and related performance measurements were appropriate for the screening process and represented an objective multidisciplinary set of criteria.

The memorandum presented step-by-step guidance for development of alternatives and their subsequent screening. Steps were necessarily added or modified throughout the screening process at the request of the project team as new information became available, as additional investigation warranted, and/or as new discoveries about alignment or modal alternatives were made. The following summarizes the steps taken to identify action alternatives to be studied in detail in the FEIS.

Confirmation of Screening Criteria and Performance Measures

The multidisciplinary approach presented in the 2002 memorandum was reviewed by the project team. Team members conducting the review represented expertise associated with environmental, engineering, land acquisition, construction, and government standards and processes. Using a diverse group ensured screening would be consistent with NEPA intent to use a systematic, interdisciplinary approach when determinations may have an effect on the human and natural environment. The following general categories reflect the criteria established for the screening process (*Alternatives Screening Report* [2003], see sidebar on page 3-2):

- ▶ ability to satisfy purpose and need, namely by improving operational characteristics of the region’s transportation system
- ▶ ability to minimize impacts on the human and natural environments
- ▶ degree of public and political acceptability
- ▶ consideration of overall conceptual cost estimates

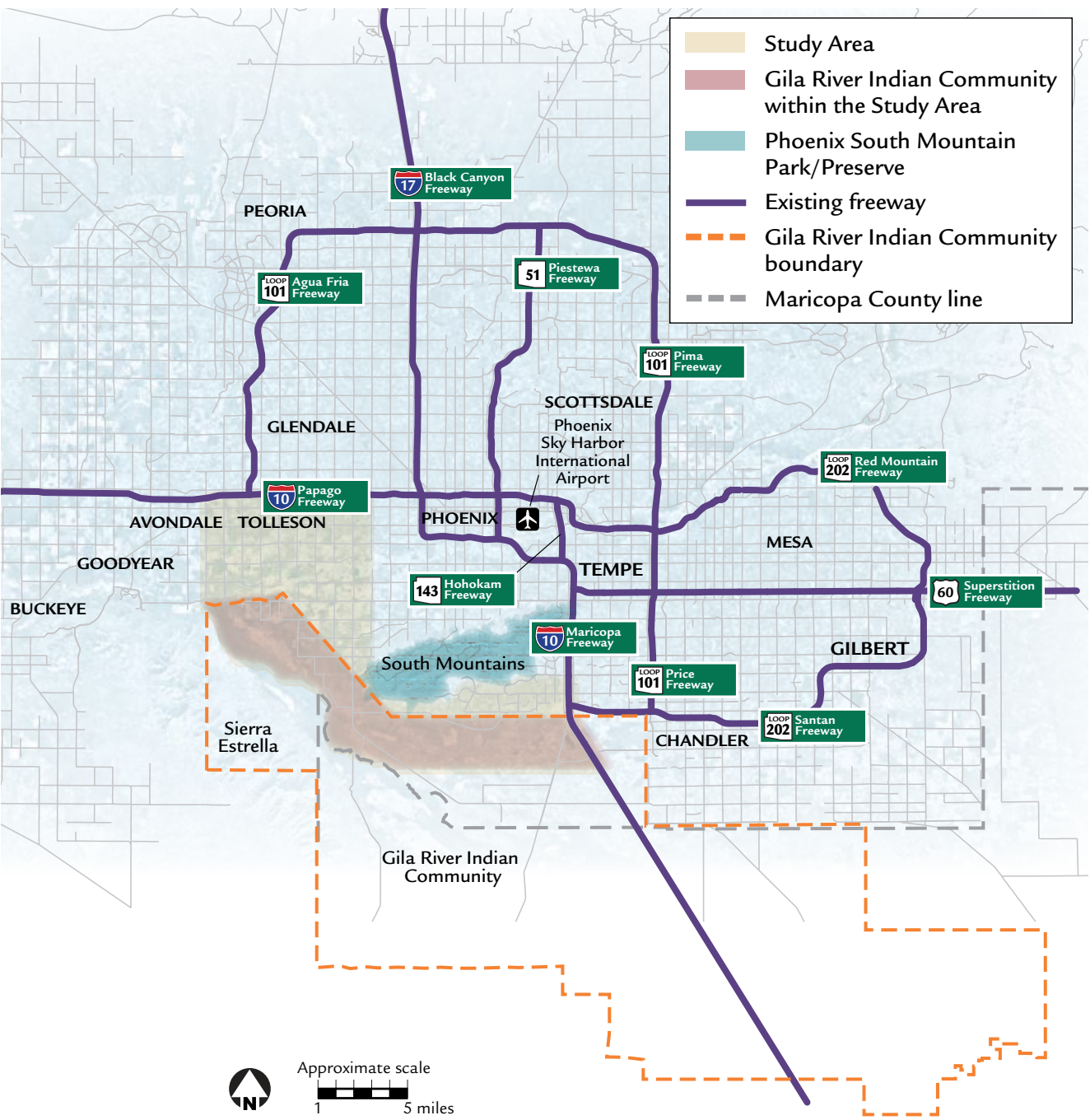
Modal Screening

Modal screening is performed to analyze the potential of various transportation modes (either individually or in combination) to meet the purpose and need of a proposed action. To minimize environmental impacts, the modal screening strategy involves looking first at those modes that would create the least impact while meeting purpose and need criteria. If these criteria cannot be satisfied with the low-impact modes, others with greater impact but more capability of meeting the proposed action’s purpose and need are examined. The process continues in this way until only those modes able to meet purpose and need criteria remain (or do so in concert with earlier-considered modes), thus satisfying these criteria while reducing impacts.

The project team considered a wide range of modal alternatives to improve transportation conditions in the Study Area (see also Table 3-2):

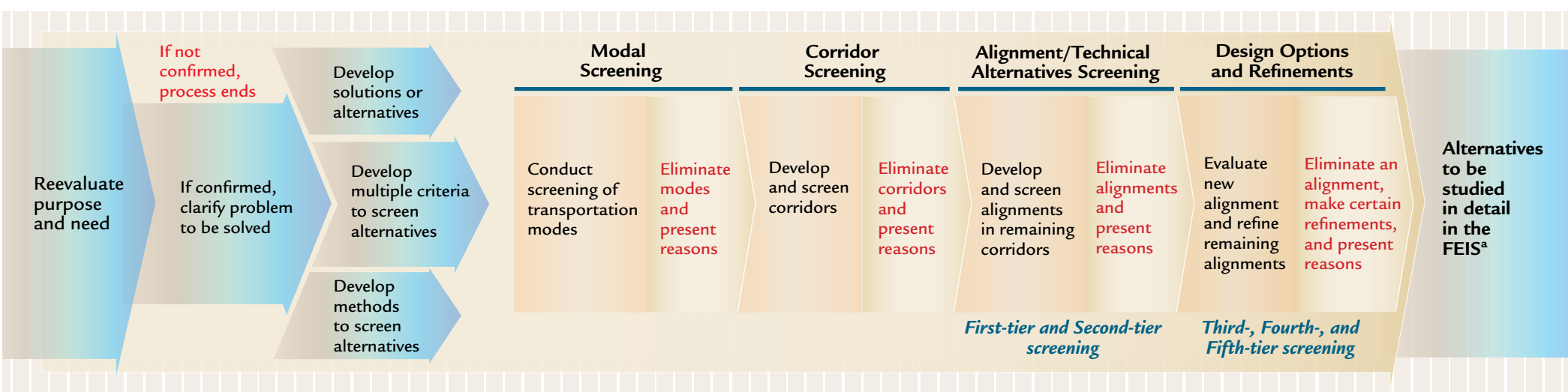
- ▶ **TSM** – maximizing the efficiency of existing transportation facilities
- ▶ **TDM** – reducing demand on existing transportation facilities

Figure 3-1 Regional Context, Proposed Action



The Study Area for the proposed action is in the southwestern portion of Maricopa County and is strategically positioned where a gap exists in the regional transportation system’s loop freeway network. The study of viable alternatives was limited by the topographical constraints of the South Mountains and by the inability to study alternatives in detail on Gila River Indian Community land.

Figure 3-2 Alternatives Development and Screening Process



^a Final Environmental Impact Statement

Identification of alternatives for detailed analysis followed logical steps, beginning with determination of the proposed action’s purpose and need and progressing to consideration of transportation modes and then corridors and alignments. Specific multidisciplinary criteria were established prior to the screening process to guide determinations.

What is a multidisciplinary process?

When passing NEPA, Congress wanted agencies to use a process that integrated a multitude of factors when making determinations about public programs and projects. Specifically, all federal agencies should apply “a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts in planning and decision making which may have an impact on man’s environment” [42 United States Code § 4332 Sec. 102(A)]. The “multidisciplinary” process as applied in the analysis of the proposed action and presented in this chapter is a reflection of this Congressional intent.

- **Transit** – increasing capacity of the existing transit network
- **Arterial street expansion** – increasing capacity of the existing arterial street network
- **Existing freeway expansion** – increasing capacity of the existing freeway network
- **Land use** – reducing demand from existing and planned land uses
- **New freeway** – providing new freeway segments

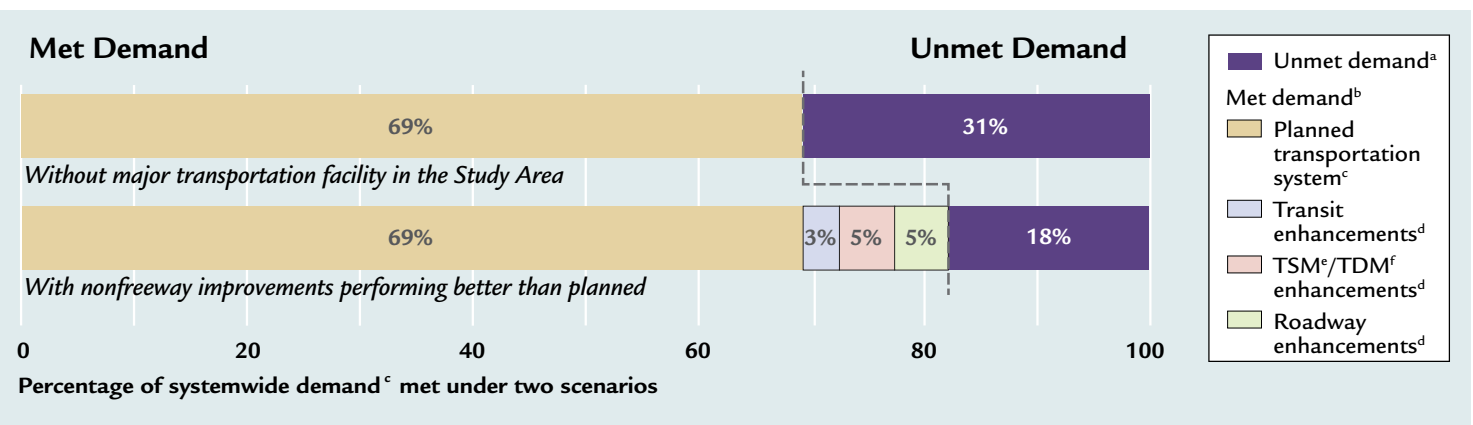
Modal Screening Results

Freeway and nonfreeway alternatives were evaluated both as individual alternatives and in combination. Nonfreeway alternatives would provide transportation system improvements in the Study Area in lieu of a new freeway facility. Nonfreeway alternatives were ultimately eliminated from further study because they did not meet the purpose and need criteria for the project; chiefly, they did not support criteria related to transportation demand and capacity deficiencies. If better-than-planned scenarios for such modal alternatives as nonfreeway planned improvements (e.g., increases in funding, increases in the number of express bus routes, increases in ridership for transit modes) were to occur, 13 percentage points of the 31 percent capacity deficiency would be accommodated (Figure 3-3); the network would still maintain an 18 percent capacity deficiency.

A brief description of these alternatives and reasons for eliminating each from detailed study are provided in Table 3-2. Notable observations include:

- Funding for TSM/TDM strategies is included in the RTP and these strategies will continue to

Figure 3-3 Met and Unmet Demand with and without Modal Improvements, 2035



Source: Maricopa Association of Governments, 2013c; extrapolated analysis

^a Unmet demand means delays and congestion for travelers on the Maricopa Association of Governments (MAG) transportation network.
^b Data are extrapolated from the 41st Street cut-line analysis (see Figure 1-11 on page 1-19) to characterize performance for the entire MAG transportation system.
^c The analysis assumes that the MAG Regional Transportation Plan is fully implemented.
^d improvements that could occur in the better-than-planned scenario
^e transportation system management
^f transportation demand management

Even when incorporating the most optimistic scenario for adoption and performance of nonfreeway improvements, 31 percent capacity deficiency would be reduced by 13 percentage points, leaving an 18 percent systemwide capacity deficiency in 2035.

be implemented throughout Maricopa County. Examples of how elements of the TSM/TDM Alternative would be implemented include the use of ramp metering; overhead, automated, advanced warning signs; freeway cameras for monitoring traffic flow/and other intelligent transportation system technology to enhance operational characteristics; ride share programs; Maricopa County Trip Reduction Program; and van pool programs. Alone, this alternative was eliminated from further study because:

- Even better-than-planned performance of TSM/TDM would not be sufficient to adequately address the projected 2035 capacity deficiency.
- TSM/TDM strategies would have limited effectiveness in reducing congestion along freeways and arterial streets in the Study Area.
- Funding for the expansion of transit modes in the MAG region is included in the RTP. Modes being considered in the Study Area include light rail, commuter rail, bus routes, and van pools. By themselves, these modes were eliminated from further study because:
- Even better-than-planned performance of transit would not be sufficient to adequately address the

Table 3-2 Nonfreeway Alternatives Considered and Reasons for their Elimination from Further Study

Alternative	Element	Description	Reason for Elimination
TSM ^a /TDM ^b	TSM	TSM attempts to maximize the safety and efficiency of the existing transportation network using auxiliary lanes, turning lanes, and Freeway Management System elements (electronic message signs, signals to meter traffic flow at on-ramps, closed-circuit television cameras, and vehicle detectors).	These alternatives alone would have limited effectiveness in reducing overall traffic congestion in the Study Area and, therefore, would not meet the purpose and need criteria; specifically, they would not adequately address projected capacity and mobility needs of the MAG ^c region (see Table 1-2, <i>Regional Transportation Plan Highlights</i> , on page 1-10, and Figure 3-3, which describe the contributions of these improvements to meeting regional transportation needs). Elimination does not preclude the use of these elements in combination with the freeway mode, nor does it preclude them from being implemented in the future.
	TDM	TDM encourages reductions in travel demand in the existing transportation network by promoting alternative modes of travel, including riding a bus, carpooling, van pooling, walking, bicycling, using alternative work schedules and compressed work schedules to reduce trips, and telecommuting.	
Transit	Light rail	The first segment of the Central Phoenix/East Valley Light Rail Transit project has been completed through central Phoenix, northern Tempe, and northwestern Mesa. While expansion routes are being studied, none would link the western and eastern termini of the Study Area.	
	Commuter rail	Commuter rail is designed to primarily meet the needs of regional commuters with service between suburbs and urban centers for the purpose of reaching activity centers, such as employment, special events, and intermodal connections. Commuter rail service would be provided only during peak times and in the peak direction. The MAG region is not currently served by commuter rail. All active heavy rail tracks in the region are used for freight.	
	Bus routes/Van pools	Express bus routes generally provide service to and from “hubs” (e.g., park-and-ride lots, downtown city centers, major employment centers). Travel could be by freeway or arterial street. Park-and-ride lots permit commuters to park vehicles to take express buses. Van pools allow groups of commuters to use community vans to commute to and from work; these function similarly to express bus routes, but with fewer individuals participating.	
Arterial Street Network Expansion	<ul style="list-style-type: none">• Add more lanes to existing arterial streets• Improve intersections• Create new arterial street routes	Improvements to the arterial street network beyond those improvements as planned in the RTP ^d and municipal general plans would occur under this alternative.	Based on projected regional travel demand and the extent of mobility needs of the MAG region and in the Study Area, arterial street network improvements alone would not meet the needs of the MAG region (see Table 1-2, <i>Regional Transportation Plan Highlights</i> , on page 1-10, and Figure 3-3, which describe the contributions of these improvements to meeting regional transportation needs).
Land Use	<ul style="list-style-type: none">• Increase residential densities• Redistribute employment centers	The alternative proposes to alter planned land uses to reduce the region’s dependence on the use of single-occupancy vehicles and to reduce demand on and increase efficiency of the MAG region’s transportation network. In support, local governments could institute services to improve performance of transit-related components of the system.	Planned land uses and associated densities in the Study Area have remained relatively unchanged since the mid-1980s. A major transportation facility in the form of the South Mountain Freeway is generally consistent with the City of Phoenix <i>General Plan</i> , and planned land uses and transportation improvements are reflected in the plan. Although the City of Phoenix has a program to discourage longer trips in the region through the village planning concept and process, accommodation of regional travel is an integral element of the plan. The Land Use Alternative is not a viable alternative because no plans exist to alter planned land uses in the region, and components to support increased efficiency in the transportation network (e.g., transit, local arterial street network improvements) are already planned in the RTP.

^a transportation system management ^b transportation demand management ^c Maricopa Association of Governments ^d *Regional Transportation Plan*

projected 2035 capacity deficiency.

➤ Two high-capacity transit corridors are being considered near the western and eastern extents of the Study Area: 1) Interstate 10 (I-10, Papago Freeway) extension from downtown Phoenix west to 79th Avenue and potentially north to the Glendale sports complexes and 2) Tempe South extension from State Route (SR) 202L (Red Mountain Freeway) to SR 202L (Santan Freeway). Both extensions are currently under study (see

the Web site, <valleymetro.org/projects_and_planning/current_projects>, for more information). By themselves, such extensions would not adequately address the projected 2035 capacity deficiency.

➤ MAG completed a series of studies in 2010 to evaluate the feasibility of commuter rail in the region. One corridor, Yuma West, includes the Union Pacific Railroad (UPRR), which passes through the Study Area. The study results support the conclusion that,

by itself, commuter rail would not meet projected regional capacity and mobility needs.

➤ Funding for expansion of the arterial street system in the MAG region is included in the RTP. Arterial street improvements were eliminated from further study because, by themselves:

➤ Even better-than-planned performance of arterial street improvements would not be sufficient to adequately address the projected 2035 regional capacity deficiency.

- The only Study Area arterial street connection of southeastern Phoenix to southwestern Phoenix around the South Mountains is the combination of Riggs Road, Beltline Road, and 51st Avenue through the Gila River Indian Community (Community). As an alternative, this route would not be sufficient to adequately address the projected 2035 regional capacity deficiency. Expansion of 51st Avenue, Beltline Road, and Riggs Road within Community boundaries would require approval of the Community.
- The City of Phoenix has indicated it will not extend an arterial street through Phoenix South Mountain Park/Preserve (SMPP) to improve connectivity between southeastern and southwestern Phoenix. The alternative was eliminated because it would not provide the capacity needed to meet the proposed action's purpose and need criteria, would result in impacts similar to those of the proposed action, and is not supported by the City of Phoenix.
- Alteration of land use and land use controls could be used to reduce regional travel needs. The adopted City of Phoenix *General Plan* identifies goals and objectives to continue to promote development of primary and secondary cores, or villages, to centralize commercial and mixed use developments. First presented in the City's *General Plan* in the mid-1980s, an integrated focus of the city's 15 villages is to create hubs to promote the use of other modes of transportation such as transit, bicycle, and pedestrian travel. This alternative was eliminated from further study because:
 - Although the City's plan encourages local travel through its villages—in contrast to regional travel—accommodation of regional travel is an integral element of the plan.
 - No plans exist to alter planned land uses in the region, and components to support increased efficiency in the transportation network (e.g., transit, arterial street network improvements) are already planned in the RTP.
- A freeway/light rail combination alternative would integrate a freeway and light rail system into a single transportation corridor. As considered, the light rail segment would be located within the freeway right-

of-way (R/W), either within the freeway median or along the outside of the freeway main line. Integration of a freeway and a light rail system into a single transportation corridor is planned in the RTP at two locations: along I-10 (Papago Freeway) and along SR 51 (Piestewa Freeway). These two segments would connect to the light rail system currently in operation.

- With these two freeway/light rail segments already in planning stages in the RTP, members of the public identified what would appear to be a similar opportunity along the route of the proposed freeway. Most freeway/light rail combinations, however, radiate from a central demand generator (e.g., a central business district or major airport). Light rail along the alignments would be inconsistent with a radial transit model and would not be able to connect to existing light rail or the planned extension. While light rail segments are planned in the RTP near the western and eastern termini of the Study Area, no funds are available or anticipated to support a combined system through the Study Area. The additional R/W (light rail generally needs a 50-foot-wide corridor) for the alternative would generate substantial community impact (e.g., displaced residences and businesses, community character and cohesion, and parkland impacts). Therefore, the alternative was eliminated from further study. Such a system could be evaluated at a later time as a future transportation option.

The freeway mode for the proposed action was determined to be an appropriate response to the purpose and need criteria for the project in that it met the criteria while minimizing impacts (see the section, *Responsiveness of the Proposed Freeway to Purpose and Need Criteria*, beginning on page 3-27). The freeway mode resulted in additional benefits, including those related to system linkage, regional mobility, and consistency with regional and local long-range plans (see the section, *Additional Benefits of the Proposed Freeway*, on page 3-35).

Combinations of nonfreeway and freeway alternatives were considered. Where appropriate, the freeway mode of the proposed action would incorporate aspects of nonfreeway alternatives to optimize traffic operational

characteristics in the Study Area and to minimize impacts. For example, high-occupancy vehicle (HOV) and auxiliary lanes would be incorporated into the freeway mode design to optimize efficient traffic flow. Electronic messaging would alert motorists to important changes in travel and traffic conditions. Existing and potential park-and-ride lots would be strategically integrated into freeway-mode alignments and mass transit routing.

Corridor Screening

The first step after determining a freeway to be the suitable transportation mode was identification of broad corridors where distinct alignment alternatives could be developed, environmental screening criteria applied, and alignments' operational performance could be compared. Each corridor was established as a large land area to:

- develop alignment alternatives based on past studies and input from agencies and the public
- identify design controls and avoid identified undesirable conflicts with environmental conditions
- compare the operational performance of alignment alternatives in the corridors in the context of purpose and need criteria and regional operation of the MAG transportation network

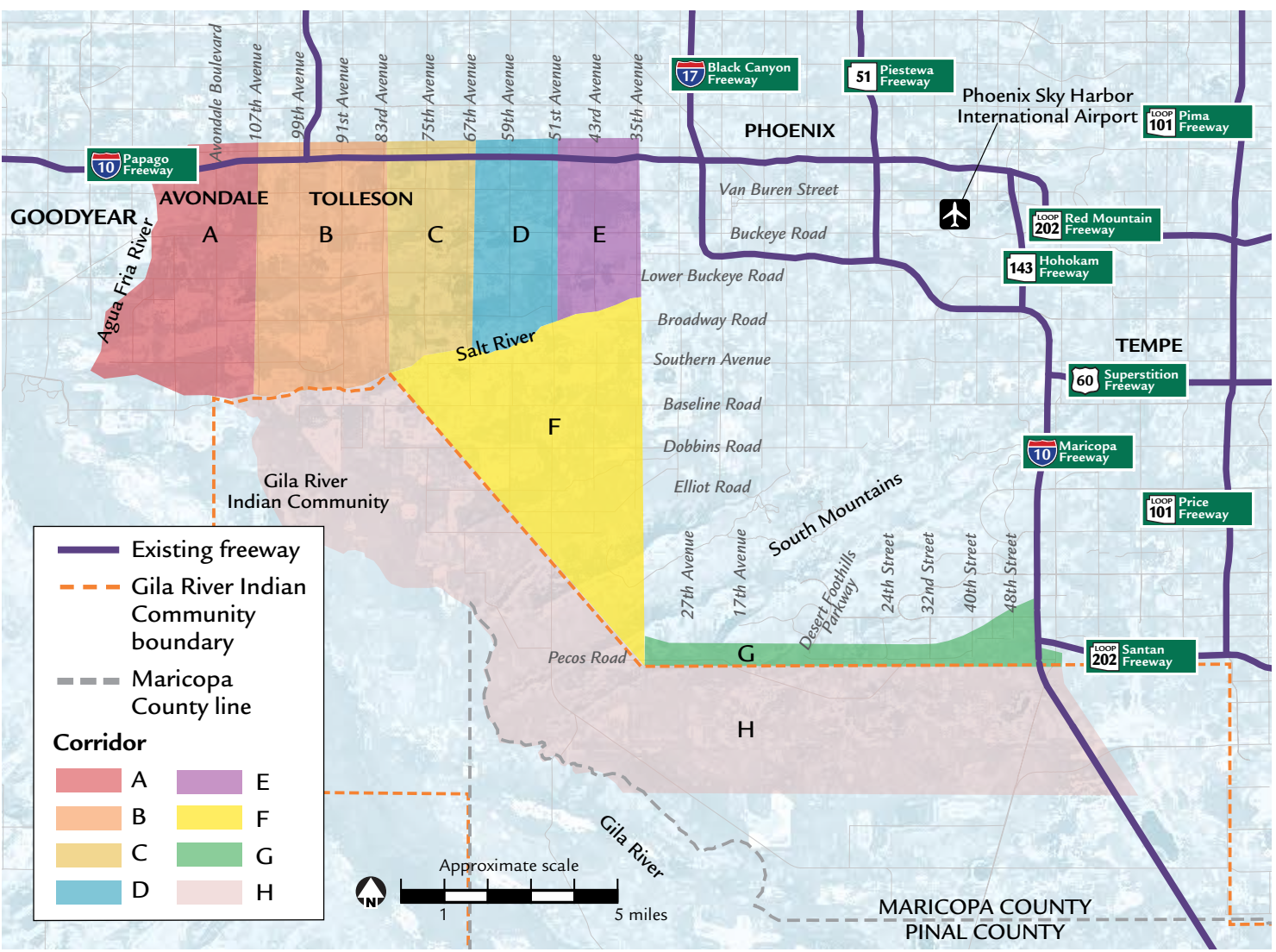
Figure 3-4 illustrates the location of the corridors within the Study Area. Notable observations are:

- Corridor H was located within Community land. A corridor along Pecos Road (Corridor G) followed an alignment consistent with previously published and adopted alignments since the mid-1980s. The other eastern corridor (Corridor F) included alignments that would connect to I-10 north of the South Mountains.
- Five corridors (Corridors A–E) were established north of the Salt River, between the Agua Fria River to the west and 35th Avenue to the east. These were created because of possible differences in effects on the operational characteristics of I-10 (Papago Freeway).

Corridor Screening Results

Using the following criteria, a comparative analysis was conducted to determine whether any of the corridors could be eliminated from further study, because alignments in a given corridor would:

Figure 3-4 Corridor Locations, Alternatives Development and Screening Process



The first step after determining a freeway to be the suitable transportation mode was identification of broad corridors where distinct alignment alternatives could be developed, environmental screening criteria applied, and comparison of alignments' operational performance facilitated. Corridors A–E, north of the Salt River, could be linked through additional corridors, F–H, to Interstate 10 (Maricopa Freeway).

- not satisfy the purpose and need criteria
- result in substantially greater impacts on the environment when compared with other alignment alternatives in other corridors
- clearly not be publicly or politically acceptable
- clearly be cost-prohibitive

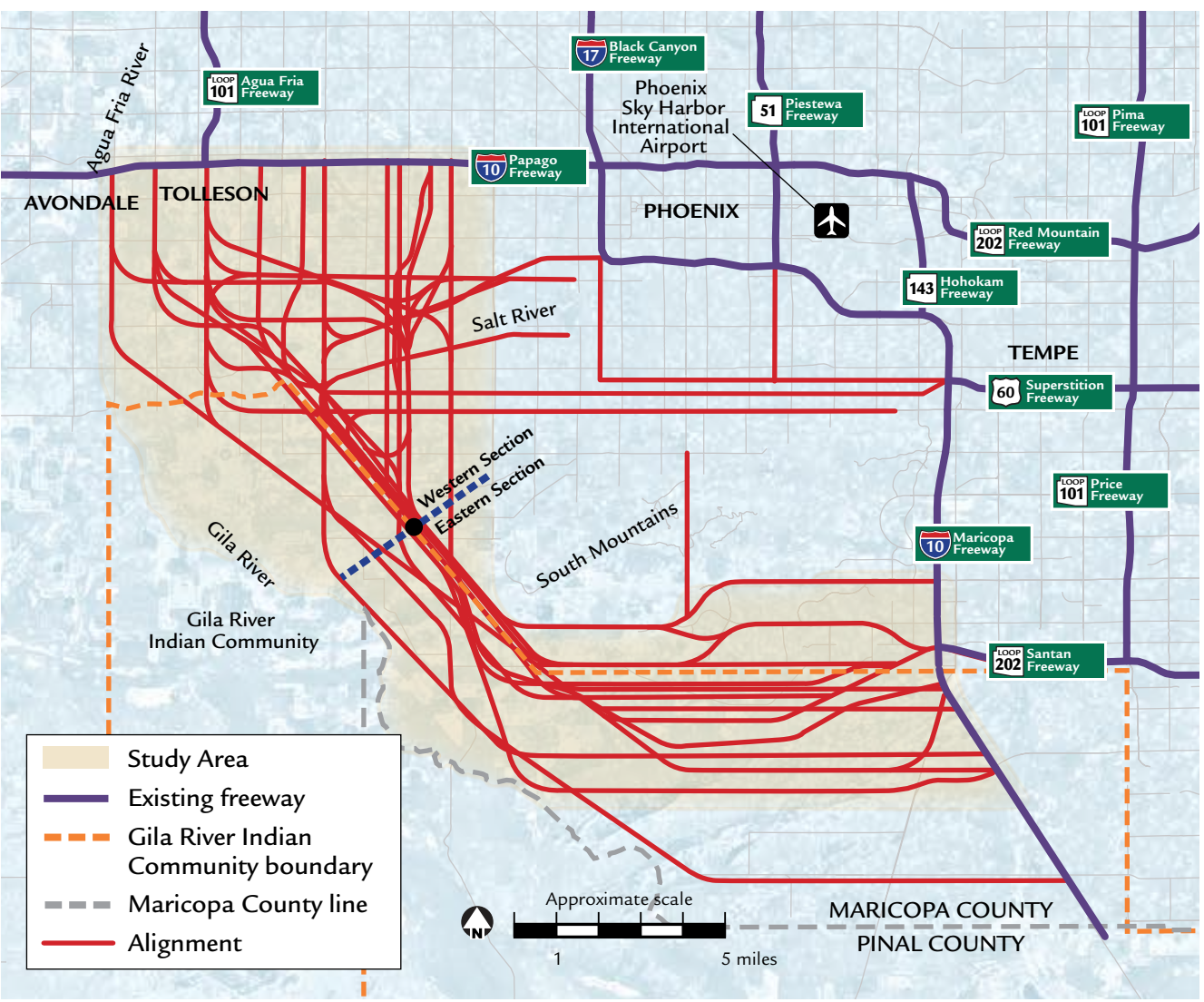
Based on a screening guided by the above criteria and traffic analyses, no alternatives were developed in Corridor A. Traffic analyses revealed a projected drop

in traffic volumes on a proposed action connection to I-10 (Papago Freeway) west of SR 101L (Agua Fria Freeway) when compared with volumes in corridors east of Corridor A. Therefore, Corridor A was eliminated from further study.

Alignment Alternatives Screening (First Tier)

Alignments were generated from previous studies, project team input, and routes provided from public input. Numerous alignments were identified

Figure 3-5 Early Alignment Siting Efforts, Alternatives Development and Screening Process



Through public input and review of past studies, the project team started with a myriad of freeway alignments through the Study Area.

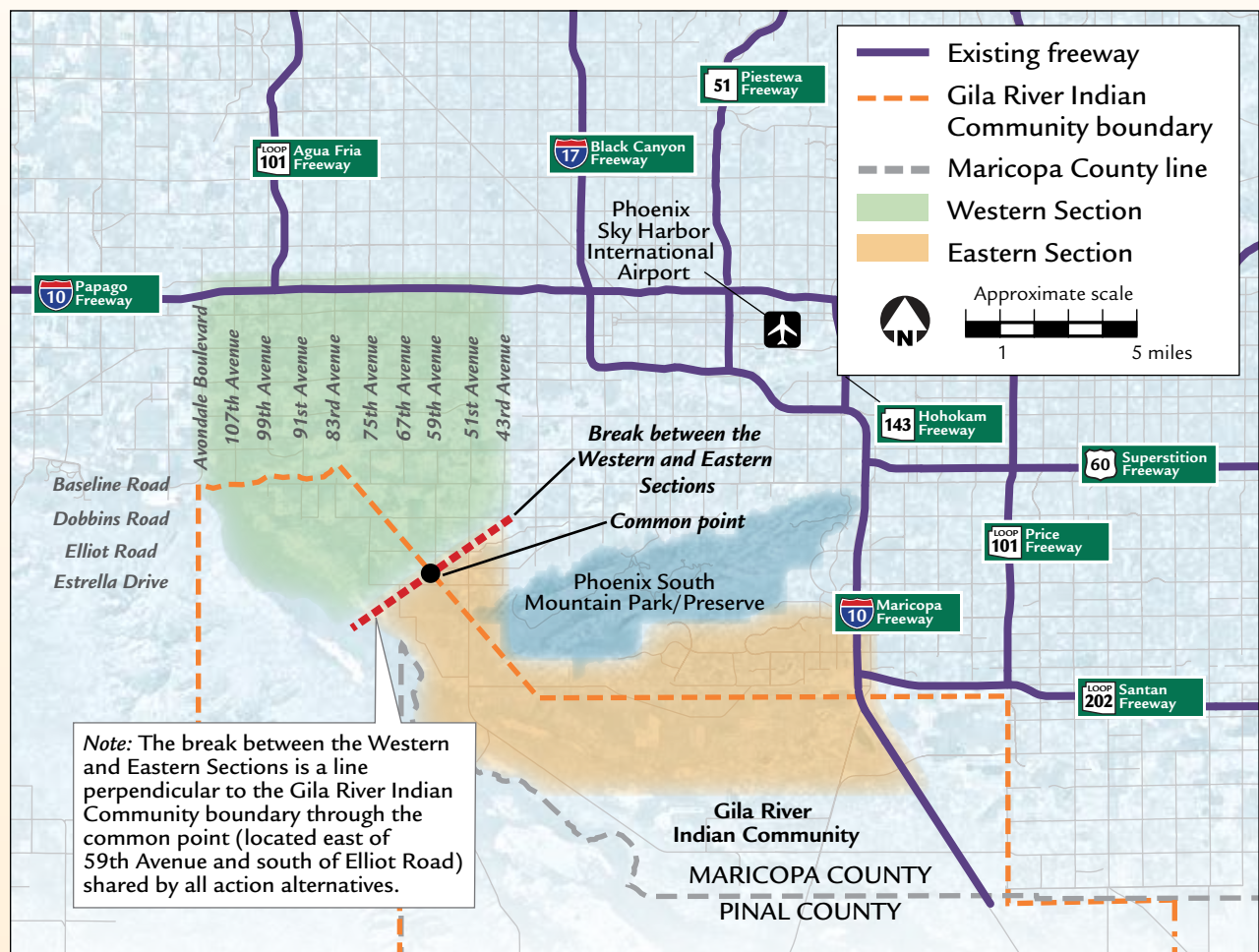
(Figure 3-5) in an initial effort requesting public preferences for freeway alignments that would contribute to creating a comprehensive set of alternatives (see Chapter 6, *Comments and Coordination*, and the sidebar on page 6-26 for more information on how the public has influenced the project). Although public preference included alignments in Corridor A, none were carried forward in the screening process because of the corridor screening results. Alternatives screened were from the Western and Eastern Sections (see text box on the next page) and from outside the Study Area.

Creation of Western and Eastern Sections for the FEIS

As shown in the map below, a common point is shared among the Study Area alignments of all action alternatives: east of 59th Avenue and south of Elliot Road. To evaluate and compare action alternatives, the Study Area is presented in two geographic sections: a Western Section and an Eastern Section. The Western Section covers the area north and west of the common point, generally from south of Elliot Road to I-10 (Papago Freeway) and from 43rd Avenue to Avondale Boulevard. The Eastern Section covers the area south and east of the

common point, generally from south of Elliot Road onto Community land and between 59th Avenue and I-10 (Maricopa Freeway).

The common point between the Western and Eastern Sections permits combining action alternatives in the Western Section with action alternatives in the Eastern Section to best satisfy the purpose and need of the proposed action. Dividing the Study Area into two sections also allows for more specific comparative impact analyses among the alternatives.



Geographic and jurisdictional constraints narrowed consideration of action alternatives in the Eastern Section of the Study Area. In the Western Section, geography and jurisdictions did not constrain the number of alternatives considered. This distinction led to identification and use of separate Western and Eastern Sections, each with its own alternative(s), to facilitate the overall alternatives development and screening process.

Several major drivers and constraints affected alignment definition and viability and guided the comparative analysis:

- **Historical Context of the Proposed Freeway** – The South Mountain Freeway was originally included in the 232-mile Regional Freeway and Highway System proposed in 1985 (see the section, *Historical Context of the Proposed Action*, beginning on page 1-5, for further discussion of project-related history). At that time, the facility, designated as a portion of SR 202L, was designed as a high-speed, access-controlled freeway with a rolling profile (see sidebar on page 3-41), grade separations, and traffic interchanges.

The South Mountain Freeway has remained in updates to MAG transportation planning documents since the mid-1980s, including the RTP. The RTP notes that the location of the South Mountain Freeway would be determined through the design concept report (DCR)/EIS study process, which is considering multiple options.

- **Status of Gila River Indian Community Alternatives at the FEIS Stage** – A key issue from the start of the EIS process has been whether ADOT and FHWA would be able to study alternatives in detail on Community land. While Chapter 2, *Gila River Indian Community Coordination*, discusses in detail the nature and extent of communication and coordination undertaken regarding the matter, this section summarizes the FEIS status of Community alternatives.

Although Figure 3-5 illustrates that the public presented numerous alternatives on Community land (within Corridor H, shown on Figure 3-4), none could be carried forward for further study.

No action alternatives under detailed study are on Community land. The Community has not granted permission to ADOT and FHWA to study alternatives in detail within its boundaries. See the discussion in *Alignment Screening and Further Design Adjustments (Fifth Tier)*, beginning on page 3-24, of the project team's preliminary analyses of an alignment—but not an action alternative—

on Community land. As a sovereign nation, the Community must grant permission to the State and rescind Resolution GR-126-00 before any alternatives that would cross Community land can be developed. If permission were granted and (after being studied) an action alternative on Community land were subsequently identified as the Selected Alternative, the Community would have to grant additional permission to ADOT and FHWA to construct the alternative.

Despite the efforts to formally study an alternative in detail on Community land, ADOT and FHWA have determined that an alternative alignment on Community land is not feasible. The EIS process of evaluating the proposed action in locations other than on Community land will continue and, in so doing, the process maintains consideration of a range of reasonable alternatives.

- **Treatment of the South Mountains as Resources Afforded Protection under Section 4(f) at the FEIS Stage** – The geographic and regulatory relationship of the proposed action to resources of the South Mountains afforded protection under Section 4(f) of the Department of Transportation Act influences both the alternatives under study and Community coordination. Details can be found in Chapter 5, *Section 4(f) Evaluation*.

First-tier Screening Results

From the many alignments assessed with respect to termini, location, system operational performance, impact avoidance or reduction, and local access, the project team created alignment alternatives that:

- best fit the intent of the numerous alignment alternatives suggested
- conformed to design standards
- avoided major conflicts with known environmental constraints

The following are examples of how alignment alternatives were adjusted:

- Some alignment alternatives provided by the public would have the proposed action located in place of

major arterial streets. A design goal for the proposed action is to add capacity to the network, not replace it. Therefore, where possible, alignments were moved off arterial streets to locations between arterial streets to optimize operation of the alignment alternatives and the arterial street network.

- Some alignment alternatives were placed down the main channel of the Salt River to avoid major conflicts with residential, commercial, and industrial uses. Such alignments would have substantial water-related impacts and be subject to regulation under Section 404 of the Clean Water Act (CWA) (see the section, *Waters of the United States*, beginning on page 4-116). Therefore, alignments were adjusted to avoid these potential effects.
- Certain alignment alternatives would have affected SMPP. Because SMPP is a resource afforded protection under Section 4(f), alignments were adjusted to reduce impacts on the resource [see Chapter 5, *Section 4(f) Evaluation*, for additional detail].

Western Section

Figure 3-1 illustrates the location of the mountains relative to the Community boundary. The previous bullets described why alternatives could not be studied in detail on Community land. As such, any alignment alternative located within Corridor G (south of the mountains and north of the Community) would have to pass through the mountains to connect to Corridor F. Having an alignment through the mountains, though, would be consistent with what has been planned since the mid-1980s. In published regional and local planning documents and in updates to those documents since the mid-1980s, a freeway similar to the proposed freeway is clearly shown passing through the mountains.

Figure 3-6 illustrates the locations of the resulting nine alignment alternatives in the Western Section. As part of this step, a report (*Alternatives Screening Report* [2003], see sidebar on page 3-2) was developed to detail anticipated impacts for each of the nine technical alternatives using criteria relating to traffic performance, design, environmental considerations, and planning-level cost estimates. In the report, the alignment alternatives were referred to as Technical Alternatives T01 through T09 (see Figure 3-6). The project team, including key

stakeholders, determined which alternatives best satisfied the screening criteria, and these alternatives were then carried forward for subsequent analysis and possible inclusion in the FEIS.

Eastern Section

Figure 3-6 illustrates the locations of the nine alignment alternatives in the Eastern Section carried forward into the next step of the screening process.

Other Alternatives Eliminated from Further Study

In this screening step, in addition to refining alignments in the corridors in the Western and Eastern Sections, alternatives identified outside the Study Area were subjected to a screening analysis. The Riggs Road Alternative and SR 85/Interstate 8 (I-8) Alternative were assessed using criteria presented for the corridor and Western Section First-tier screening processes. A description of each alternative and reasons for its elimination are provided below.

Riggs Road Alternative

The Riggs Road Alternative would replace 51st Avenue south of its connection to I-10 (Papago Freeway) for approximately 21 miles. It would then replace approximately 4 miles of Beltline Road in an easterly direction. At the Riggs Road/SR 347 intersection, the alternative would replace approximately 3 miles of Riggs Road before connecting to I-10 (Maricopa Freeway) at the existing I-10/Riggs Road service traffic interchange.

Nearly two-thirds of the alternative would be on Community land. While the Riggs Road Alternative would serve regional mobility needs, particularly of those living in the Maricopa area, meeting this travel demand would not address any specifically identified planning goals for an integrated regional transportation network. The RTP identifies the proposed action as a critical link in the Regional Freeway and Highway System, both in completing it and in optimizing overall system performance as well as that of specific existing links such as SR 202L (Santan Freeway). The Riggs Road Alternative would not complete the loop system as part of SR 202L, thereby causing substantial out-of-direction travel for motorists. Therefore, the alternative would not meet the proposed action’s purpose and need criteria and was eliminated from further study.

SR 85/I-8 Alternative

The SR 85/I-8 Alternative would begin at I-10 approximately 32 miles west of downtown Phoenix and would either replace or widen SR 85 for approximately 33 miles south before connecting to I-8 in Gila Bend. It would then replace or widen I-8 for approximately 63 miles east before reconnecting with I-10 at Casa Grande, approximately 56 miles south of downtown Phoenix (see map on page 3-64). SR 85 is currently being reconstructed as a four-lane, divided highway with limited-access control, and I-8 is a four-lane, divided Interstate freeway with full access control. Existing signs at each terminus designate the route as a truck bypass of downtown Phoenix. This route would continue to be available for interstate and inter-regional travel, but it does not meet the proposed action purpose and need as part of a regional transportation network and, therefore, it was eliminated from further consideration.

Technical Alternatives Screening (Second Tier)

Western Section

The operational characteristics of the nine technical alternatives in the Western Section were compared to determine whether any of the technical alternatives could be eliminated from further study. Traffic modeling results were used to assess how simulated traffic would travel on the technical alternatives and how the traffic from the alternatives would interact with traffic on I-10 (Papago Freeway) (*Alternatives Screening Report* [2003], see sidebar on page 3-2).

The technical alternatives were based on an assessment of operational performance combined with consideration of other criteria (e.g., displacements and relocations, traffic performance, compliance with design standards, preliminary R/W requirements, and planning-level cost estimates).

Eastern Section

The nine Eastern Section alternatives were screened primarily on the severity of community-related impacts (e.g., displacements and relocations, community character and cohesion impacts). Other factors were also considered (e.g., operational characteristics, compliance with design standards, preliminary R/W requirements, planning-level cost estimates).

History of naming action alternatives

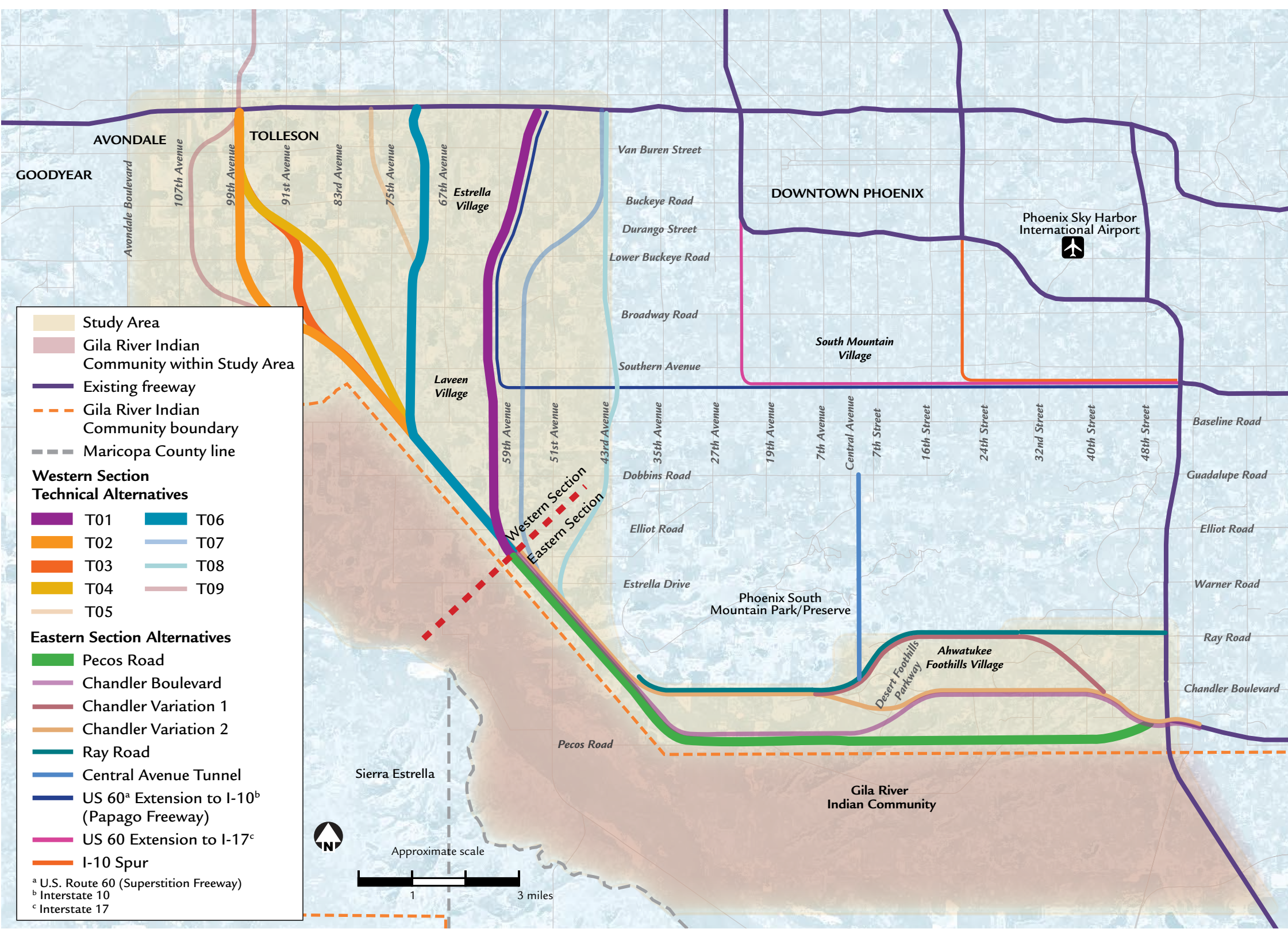
The names of the action alternatives studied in detail in the FEIS resulted from comments received from the public and participating agencies. The names serve as geographical references based on each alternative’s location in the Study Area and its relationship to the Interstate, regional freeway, and arterial street networks.

All action alternatives were assigned a letter, using “W” for Western Section alternatives and “E” for Eastern Section alternatives.

Action alternatives in the Western Section were then assigned numbers based on the alternatives’ western termini in relation to their connections to I-10 (Papago Freeway) (e.g., “71” for the I-10 connection at 71st Avenue and “101” for the I-10 connection at the I-10/SR 101L interchange). Because only one action alternative is being studied in detail in the Eastern Section, it was assigned the number “1.”


Each alignment option of the W101 Alternative was named based on its relative geographical location among Western, Central, and Eastern alignments (*Renaming of Alternatives for the Draft EIS Memorandum* [2006], see sidebar on page 3-2).

Figure 3-6 Western and Eastern Section Alternatives, First-tier Screening, Alternatives Development and Screening Process



As a result of the First-tier screening, nine alternatives in the Western Section and nine alternatives in the Eastern Section were carried forward for further study.

Table 3-3 Western Section Alternatives Eliminated from Further Study, Second-tier Screening, Alternatives Development and Screening Process

Location of Alternatives Eliminated	Alternative	Reason for Elimination
	T05	<ul style="list-style-type: none">Operational failure experienced on I-10^a (Papago Freeway) between 83rd Avenue and SR 101L^b because of two system traffic interchanges within 3 miles of each otherSubstantial cost and right-of-way associated with system traffic interchange ramps and connector roads
	T07	<ul style="list-style-type: none">Operational failure experienced on I-10 (Papago Freeway) between 43rd Avenue and I-17^c because of two system traffic interchanges within 3 miles of each otherSubstantial impacts to existing and planned residential and commercial developmentsSubstantial cost for construction and right-of-way acquisition associated with displacements and system traffic interchange ramps and connector roads
	T08	<ul style="list-style-type: none">Operational failure experienced on I-10 (Papago Freeway) between 43rd Avenue and I-17 because of two system traffic interchanges within 3 miles of each otherSubstantial impacts to existing and planned residential and commercial developmentsSubstantial cost for construction and right-of-way acquisition associated with displacements and system traffic interchange ramps and connector roads
	T09	<ul style="list-style-type: none">Connection to SR 101L would require sharp curves that would limit the speeds allowed on the freeway to a maximum of 45 miles per hourSubstantial impacts to existing and planned residential and commercial developments in Tolleson and AvondaleSubstantial cost of right-of-way acquisition associated with displacements

^a Interstate 10 ^b State Route 101L (Loop 101) ^c Interstate 17

Second-tier Screening Results

Western Section

Four of the nine technical alternatives were eliminated from further study based on the criteria above. Reasons for elimination of Technical Alternatives T05, T07, T08, and T09 are presented in Table 3-3. While none of the alternatives were completely unacceptable (sometimes referred to as “fatally flawed”), the four eliminated were determined to generate greater operational, environmental, and/or economic impacts than the remaining five alignment alternatives.

The remaining Technical Alternatives T01, T02, T03, T04, and T06 in the Western Section were renamed (see Table 3-4). A key observation from the table pertains to Technical Alternatives T02, T03, and T04: each represents an option associated with a single action alternative in the Western Section that would connect to I-10 at its interchange with SR 101L (Agua Fria Freeway).

Eastern Section

All but one of the alignment alternatives in the Eastern Section were eliminated from further study. Reasons for elimination of the alternatives are presented in Table 3-5.

The remaining alternative, the Pecos Road Alignment (later referred to as the E1 Alternative), would do the most to avoid, reduce, or otherwise mitigate impacts on neighborhoods immediately north of Pecos Road. It would closely follow the published alignment first adopted in the 1980s.

Project Termini and Independent Utility

The Second-tier screening concluded that the three alignment alternatives in the Western Section and one alignment alternative in the Eastern Section, if combined, would connect major traffic generators and

Table 3-4 Renaming of Action Alternatives,^a Western Section

Technical Alternative Carried Forward from the Second-tier Screening Process	Alternative Name as Presented in the FEIS ^b
Technical Alternative T01	W55 Alternative or W59 Alternative ^c
Technical Alternative T02	W101 Alternative Western Option ^d
Technical Alternative T03	W101 Alternative Central Option ^d
Technical Alternative T04	W101 Alternative Eastern Option ^d
Technical Alternative T06	W71 Alternative

^a See sidebar on previous page.
^b Final Environmental Impact Statement
^c The W55 Alternative later became the W59 Alternative.
^d The three options of the W101 Alternative (W101 Alternative Western Option, W101 Alternative Central Option, W101 Alternative Eastern Option) represent horizontal alignment options to the action alternative that would connect to Interstate 10 (Papago Freeway) at its interchange with State Route 101L (Agua Fria Freeway).

Table 3-5 Eastern Section Alternatives Eliminated from Further Study, Second-tier Screening, Alternatives Development and Screening Process

Location of Alternative	Alternative	Reason for Elimination
<div><div><div>Study Area</div><div>Gila River Indian Community within Study Area</div><div>Existing freeway</div><div>Gila River Indian Community boundary</div><div>Maricopa County line</div><div>Eliminated alternatives</div><div>Eastern Section alternatives</div><div>Pecos Road</div><div>Chandler Boulevard</div><div>Chandler Variation 1</div><div>Chandler Variation 2</div><div>Ray Road</div><div>Central Avenue Extension Tunnel</div><div>US 60 Extension to I-10 (Papago Freeway)</div><div>US 60 Extension to I-17</div><div>I-10 Spur</div><div><div>Approximate scale</div><div>13 miles</div></div></div></div>	Ray Road	<ul style="list-style-type: none">Substantial impacts on traffic performance on I-10^a (Maricopa Freeway) based on three system traffic interchanges within a 6-mile segment of I-10 (including I-10/SR 202L^b/Pecos Road, I-10/Ray Road Alternative, and I-10/US 60^c)Substantial impacts on existing residences, including hundreds of residential displacementsSubstantial disruption to community character and cohesion, splitting Ahwatukee Foothills VillageLoss of road network capacity by loss of a portion of Ray RoadImpacts on commercial frontage along Ray Road and developmentsAdded costs to construct a new system traffic interchange and add capacity improvements along I-10 (in addition to what is already planned)
	Chandler Boulevard ^d	<ul style="list-style-type: none">Substantial impacts on existing residences, including hundreds of residential displacementsSubstantial disruption to community character and cohesion, splitting Ahwatukee Foothills VillageImpacts on commercial frontage along Chandler Boulevard and developmentsLoss of road network capacity by unplanned loss of portions of Chandler Boulevard and Ray Road
	Central Avenue Extension Tunnel	<ul style="list-style-type: none">Minimal improvement to traffic performance along I-10 (Maricopa Freeway) and regional mobilityAlternative would be an unplanned extension of Central Avenue and would not adequately address capacity deficiencies in the regionA tunnel under SMPP^e: up to 2.5 miles long and cost-prohibitive, undesirable for safety and emergency response, would result in direct use of a resource afforded protection under Section 4(f), and result in disproportionately high construction costs considering the percentage of vehicular trips served
	US 60 Extension to I-10 (Papago Freeway)	<ul style="list-style-type: none">Would cause substantial traffic performance impacts on I-10 (Maricopa Freeway) between SR 202L (Santan Freeway) and US 60 (Superstition Freeway)Increased undesirable congestion on US 60 (Superstition Freeway) and SR 101L^f (Price Freeway)Unintended underuse of SR 202L (Santan Freeway)
	US 60 Extension to I-17 ^g	<ul style="list-style-type: none">Would not address needs based on regional travel demand and existing and projected transportation system capacity deficiencies (would not adequately improve regional mobility by shifting traffic from arterial streets to freeways, would not adequately improve travel times)Substantial impacts on existing residences and businesses, including thousands of residential displacements and over 100 business displacements
	I-10 Spur	<ul style="list-style-type: none">Substantial disruption to community character and cohesion, splitting South Mountain Village and constructing a barrier between schools, parks, and residencesWould not be consistent with local or regional planning, which includes a freeway alternative that completes the loop system as part of SR 202L

^a Interstate 10 ^b State Route 202L (Loop 202) ^c U.S. Route 60 (Superstition Freeway)

^d Two variations of the Chandler Boulevard Alternative were considered, both of which would tie into the Ray Road Alternative. The first variation would begin at the I-10/SR 202L/Pecos Road system traffic interchange and continue northwest past Chandler Boulevard and connect with the Ray Road Alternative near 32nd Street. The second variation would follow the Chandler Boulevard Alternative alignment, but instead of joining with the existing Pecos Road alignment near Desert Foothills Parkway, the second variation would dip slightly and then follow the Ray Road Alternative along the southern SMPP boundary, where no roadway currently exists.

^e Phoenix South Mountain Park/Preserve ^f State Route 101L (Loop 101) ^g Interstate 17

provide access to the surrounding communities in the western and eastern portions of the MAG region. The potential termini of these alignments (see the text box on the next page) are consistent with the logical termini identified in the section, *Project Location, Description, and Current Status*, beginning on page 1-4.

Also, the combined alignments would have independent utility (see sidebar regarding independent utility on page 1-4) in that they would:

- ▶ not depend on other projects to serve the proposed freeway’s purpose
- ▶ be usable even if no other transportation-related improvements were made in the Study Area

Design Options and Refinements (Third Tier)

At this stage of the alternatives development and screening process, the level of design was limited to alignment locations for the proposed freeway. For project designers, however, other features associated with freeway design must be considered, such as:

Potential Termini for the Proposed Freeway



(a) I-10 at 55th and 59th avenues, looking east



(b) I-10 at 71st Avenue, looking east



(c) I-10 at SR 101L, looking east



(d) SR 202L at I-10, looking west

Source: Arizona Department of Transportation, 2005

Photos a, b, and c illustrate possible western termini on I-10 (Papago Freeway) near 59th Avenue, 71st Avenue, and SR 101L (Agua Fria Freeway), respectively. Photo d shows the possible eastern terminus, near the SR 202L (Santan Freeway) and I-10 (Maricopa Freeway) system traffic interchange, which was constructed between 2000 and 2002 to accommodate the western leg of SR 202L.

- What should the vertical profile of the freeway look like? Should it be aboveground or belowground? Or should it be a combination of both?
- Where should traffic interchanges (see sidebar on page 3-14) with the local arterial streets be located? And how many should there be?
- What should the interchanges look like? And what do drivers expect them to look like?
- Should the arterial streets go over or under the freeway?
- How will drainage for the freeway be treated?

Answers to these types of questions drive project designers to consider different options, weigh the benefits and disadvantages of each, and determine the appropriate option for each design-related issue. This section addresses those key design options and presents those options considered but eliminated from detailed study in the FEIS.

Third-tier Screening Results

Adjustments were made to the Western and Eastern Section alignment alternatives to avoid conflict with sensitive environmental resources (see sidebar on this

page) and to optimize traffic performance through improvements in freeway-to-freeway interchange geometry and through local access to and from the alignment alternatives. Examples of adjustments made to the Western and Eastern Section alignment alternatives are shown in Figures 3-7 (see the next page) and 3-8 (see page 3-15), respectively. Design details of the action alternatives are presented in the section, *Alternatives Studied in Detail*, beginning on page 3-40.

The design options that were considered and eliminated from detailed study in the FEIS are presented in the following text.

South Mountains Avoidance Options

As proposed, the Pecos Road Alignment would pass through the southwestern edge of the South Mountains. This alignment, similar to that planned since the late 1980s, would follow existing terrain except where cuts to the hillsides would be needed to pass through the ridgelines (Figures 5-9 and 5-10 on pages 5-16 and 5-17, respectively, illustrate features of the proposed ridgeline cuts).

Local residents and representatives from the City of Phoenix, Ahwatukee Foothills Village, the Community, and the South Mountain Citizens Advisory Team (SMCAT) expressed concerns that these cuts would substantially and adversely affect the South Mountains' valued resources. In response, design options were developed in an effort to avoid and/or reduce impacts on the mountains. Design options considered fell into these categories:

- Build a bridge over the South Mountains.
- Build a tunnel under the South Mountains.

Assessment of these design options concluded:

- Options to build a bridge over the South Mountains were eliminated from further study because of incident management, constructibility, and maintenance issues; future expansion limitations; substantially higher estimated construction costs; and undesirable intrusion-related impacts. (Additional information is provided in the section, *Bridge Alternatives*, beginning on page 5-20.)

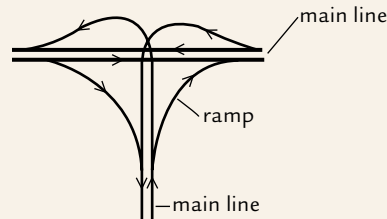
Can impacts on the environment be avoided entirely?

All alignment alternatives would generate impacts on the natural and human environment. Impacts would be unavoidable because of the size of the proposed action. Because other alignment alternatives were eliminated from further study owing to undesirable impacts on the natural and human environment, the action alternatives carried forward for detailed study in the FEIS represent actions undertaken to avoid, reduce, or otherwise mitigate impacts on the environment. By this measure, the impacts on overall resources reported later in Chapter 4, *Affected Environment, Environmental Consequences, and Mitigation*, have been reduced through the screening process.

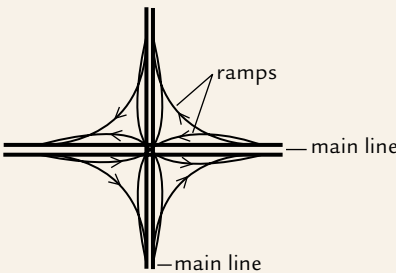
Traffic interchange configurations for the action alternatives

Traffic would gain access to the proposed freeway using system and service traffic interchanges. System traffic interchanges are interchanges connecting a freeway with another freeway, such as the I-10/I-17 Stack in downtown Phoenix. Service traffic interchanges provide freeway access to and from the local arterial street network, such as I-10 at 7th Avenue in downtown Phoenix. The action alternatives would use two types of system traffic interchanges:

Three-leg directional interchange

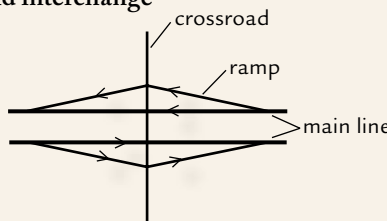


Four-leg directional interchange



The region's freeway system most often uses two types of service traffic interchanges:

Diamond interchange



Single-point urban interchange

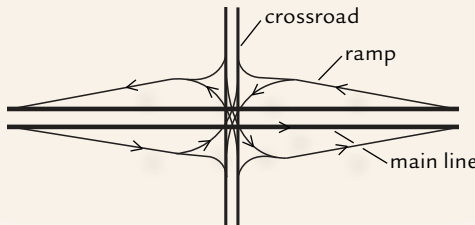
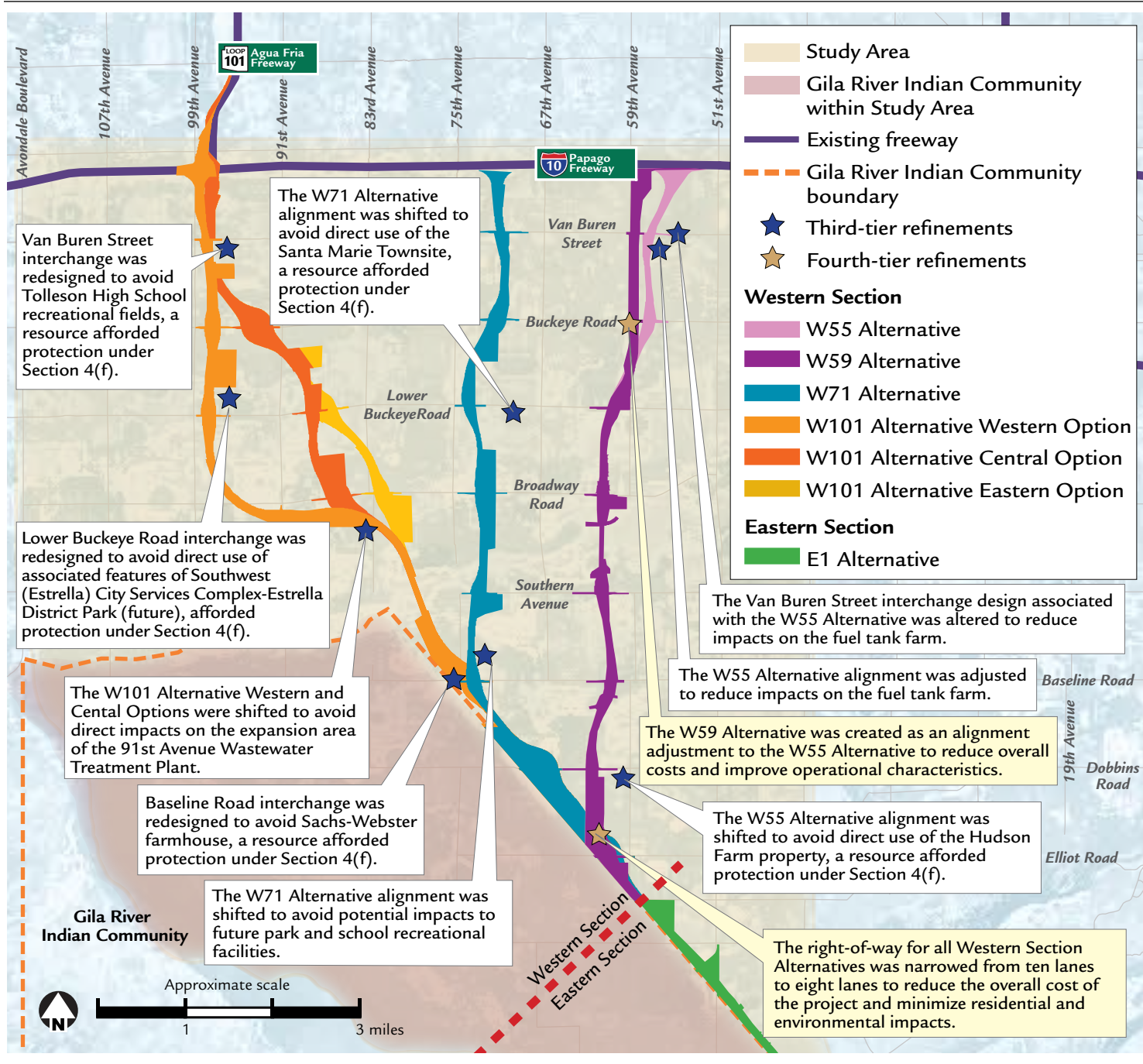


Figure 3-7 Alignment Adjustments, Third- and Fourth-tier Screening, Western Section, Alternatives Development and Screening Process



For action alternatives in the Western Section, adjustments were made early in the study process to avoid or reduce impacts on unique facilities and resources protected under Section 4(f). (The bulges and other irregular shapes depicted for the alternatives' otherwise-linear footprints reflect projected right-of-way needed for drainage basins and channels, construction staging areas, interchanges, etc.)

- Building a tunnel under the South Mountains as a design option was also assessed and, based on safety and constructibility, undesirable intrusion-related

impacts, maintenance, and construction cost, it was eliminated from further study (see text box regarding tunneling options on page 3-16 for further discussion).

System Traffic Interchange Connection Options

The major challenge in designing system traffic interchanges is ensuring efficient and safe conveyance of traffic in various directions. Design options considered for the system traffic interchanges were vertical profiles, horizontal alignments, and existing service traffic interchange ramp configurations.

The action alternatives in the Western Section (except for the W101 Alternative—see the next paragraph) would connect to I-10 (Papago Freeway) at proposed new system traffic interchanges, and existing service traffic interchanges would be reconfigured to minimize disruption of traffic operational performance on I-10. Several ramp configurations for each connection were evaluated for traffic operational characteristics. The results of this evaluation were used as the basis for eliminating ramp configurations from detailed study (*Traffic Report* [2007], see sidebar on page 3-2). Additional information is presented in the section, *System Traffic Interchanges*, on page 3-48, and *Alteration of Existing Service Traffic Interchanges*, on page 3-52.

The W101 Alternative would connect to I-10 (Papago Freeway) at the existing system traffic interchange with SR 101L (Agua Fria Freeway). Design configurations varied in the following ways:

- removal of the existing system interchange to construct a new system traffic interchange to the west or partial reconstruction of the existing system traffic interchange
- retention of an at-grade profile or use of bridges to reduce community impacts
- replacement of a section of 99th Avenue or use of a location shifted ¼ mile east of 99th Avenue

Through an iterative process using multiple criteria (with a focus on impacts on Tolleson and Avondale), options were eliminated from detailed study (*SR 202L/SR 101L Direct Connection Alternatives Screening Report* [2003] and *SR 202L/SR 101L Direct Connection Alternatives along 99th Avenue and ¼ Mile East Memorandum* [2004], see sidebar on page 3-2). A description of the options carried forward for further study is presented in the section, *System Traffic Interchanges*, on page 3-48, and *Alteration of Existing Service Traffic Interchanges*, on page 3-52.

W101 Alternative – Alignment Options

Table 3-4 on page 3-11 notes the W101 Alternative has three alignment options (Western, Central, and Eastern) approaching its connection to I-10 (Papago Freeway). Alignment options were considered for the W101 Alternative Western Option near Tolleson. In this area, the alternative would have passed through the city, generally following the alignment of 97th Avenue (if it existed) or by replacing 99th Avenue. For each, various designs were considered in attempts to reduce impacts on land uses in the immediate vicinity. The design options that would have replaced 99th Avenue were eliminated from further study because of greater business impacts, undesirable traffic and access operational considerations, and greater comparative costs (*W101 Options Screening Memorandum* [2006], see sidebar on page 3-2).

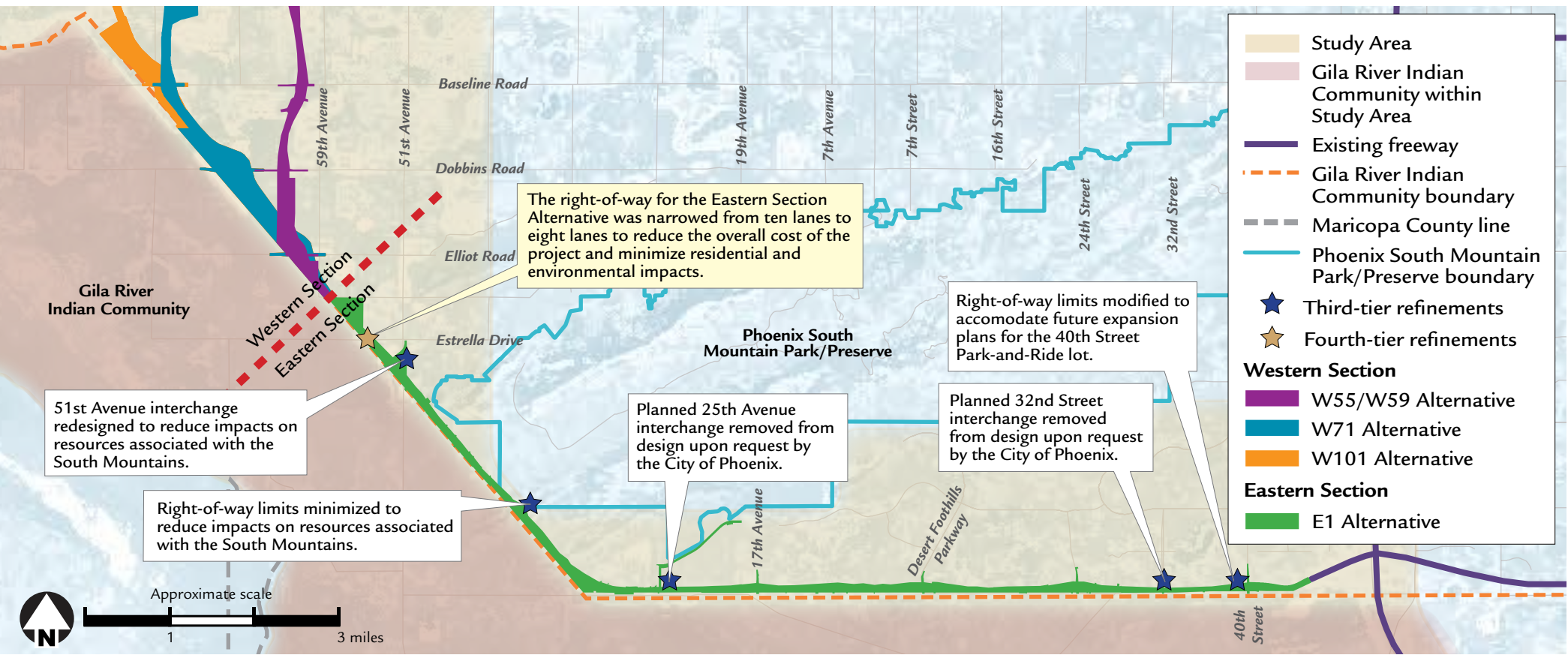
E1 Alternative – Pecos Road Variations

As highlighted in Chapter 6, *Comments and Coordination*, local residents and representatives from the City of Phoenix, Ahwatukee Foothills Village, and the SMCAT expressed concerns that the Pecos Road Alignment of the E1 Alternative would degrade air quality and would introduce substantial visual and noise intrusions into Ahwatukee Foothills Village and its surroundings, adversely affecting the social characteristics of the community (see Table 4-9, *Impacts on Community Character and Cohesion, Action Alternatives*, beginning on page 4-24, regarding impacts on Ahwatukee Foothills Village). Ongoing requests to depress the freeway through the area led ADOT and FHWA to examine two design options for this segment of the proposed freeway. The first was to develop and examine depressed freeway options. The second was to place the freeway on the utility easement located immediately south of the Pecos Road R/W (*E1 Alternative – Profile Variations along Pecos Road Memorandum* [2009], see sidebar on page 3-2).

Depressed Freeway Options

As proposed, the E1 Alternative would have a rolling profile [see the section, *E1 Alternative (Preferred Alternative)*, on page 3-48, for more information]. With the exception of the proposed freeway segments passing through ridgelines of the South Mountains, the freeway

Figure 3-8 Design Adjustments, Third- and Fourth-tier Screening, Eastern Section, Alternatives Development and Screening Process



For the action alternative in the Eastern Section, adjustments were made early in the study process to avoid or reduce impacts on residential areas and to avoid resources protected by Section 4(f). In the case of the 25th Avenue and 32nd Street interchanges, the City of Phoenix conducted a traffic analysis to evaluate the effects of removing them from the project (see Appendix 3-1).

would be at or near existing ground level but would be elevated to pass over existing arterial streets. As a basis of understanding, a profile for a freeway—and its resulting dimensions (e.g., R/W width)—is generally controlled by considerations such as:

- **Drainage** – For driver safety, freeways are designed to allow stormwater runoff to cross. This can be accomplished in a number of ways. Examples are to provide:
 - culverts to allow the runoff to cross under the freeway where it would cross naturally
 - channels to intercept runoff and direct it to another location to cross the freeway
 - retention/detention basins to collect the runoff to either meter the flow of water or to redirect it to another location
 - a combination of the above

- The size of these facilities is a function of “storm events.” Storm events are based on historic data used to predict worst-case storms during a given period. Based on historic data, a 50-year storm, for instance, is one that has a likelihood of occurring only once in 50 years. ADOT uses a minimum 50-year storm to gauge the size of drainage facilities needed for a project.
- **Subsurface conditions** – For example, a high groundwater table would need special drainage design requirements for a depressed freeway that otherwise could be avoided by using an at-grade design. Also, underground utility lines can influence the profile design; relocation of major utility lines can be extremely costly and must be considered in the context of ADOT’s fiscal responsibility.

Tunneling under the South Mountains

The South Mountains are a highly valued resource to Arizona communities (see text beginning on page 5-14 to learn more about the importance of the South Mountains). As designed, the proposed action would alter some of the mountain range’s natural landscape by converting it to a transportation use and by causing visual scars from the freeway cutting through mountain ridgelines (see the photo simulation on the left, next page). In addition, concerns have been expressed that the

proposed action would introduce an intensive human-made use into an otherwise passive, natural, and—for some—sacred setting; would reduce access to the mountain range; and would diminish wildlife habitat in the area. In response to these concerns, design options to tunnel through the South Mountains were examined.

Tunnel Engineering – As background information, the way a freeway tunnel system looks is generally controlled by technical considerations, such as:

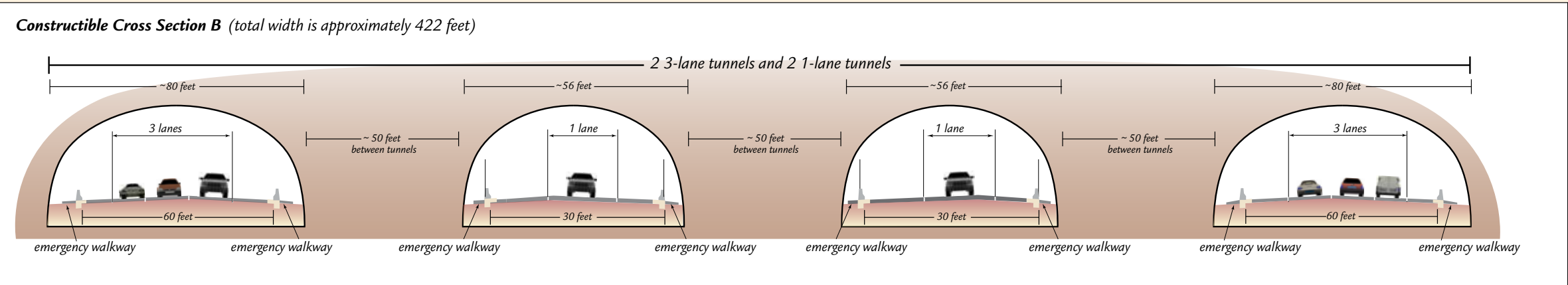
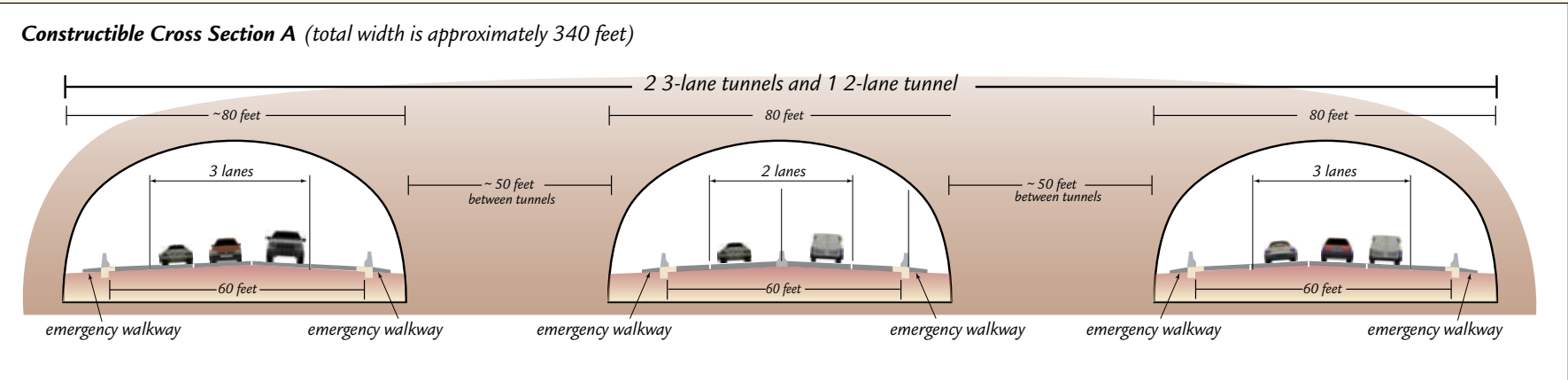
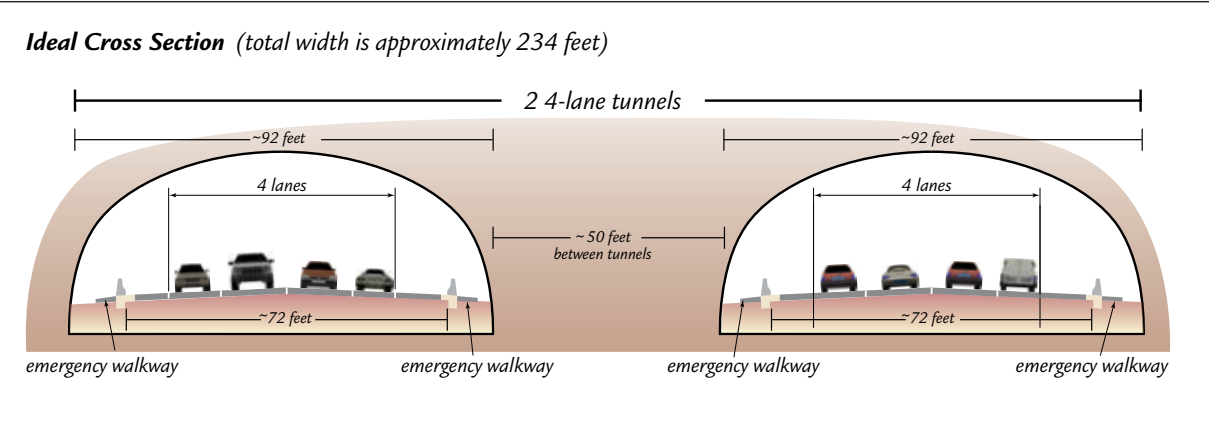
- 1. A tunnel’s dimensions and its distance below ground are dictated by existing geological conditions and available construction technology. When coupled with appropriate safety considerations, these factors basically determine a single tunnel’s size or tunnel conditions.
- 2. Once geologic and construction capabilities are determined, operational needs are considered, including the number of lanes, safe sight distances and other safety features, maintenance features, and security issues. These considerations are used to determine whether the operational needs can be met with the tunnel conditions outlined or whether more than one tunnel (located adjacent to each other) would be needed.
- 3. Finally it is necessary to determine whether the tunnel(s) would be sufficiently deep and long to avoid or reduce impacts on the surrounding environment.

When considered together, these factors helped determine the minimum acceptable tunnel dimensions (height and width), distance below ground, number of adjacent

tunnels to accommodate all of the freeway lanes, tunnel length and location, and possible construction techniques. In determining what type of tunnel could be built, ADOT and FHWA balanced traffic performance against existing technological capabilities. Tunneling options were also assessed to determine the feasibility of their construction and maintenance, to determine their effectiveness in avoiding or reducing impacts to the South Mountains, and to assess whether tunneling through the mountain range would generate other desirable or undesirable outcomes.

Three tunnel configurations were considered. All the configurations were located along the same alignment as the proposed freeway. The three graphics to the left illustrate the issues involved with each of these configurations. Based on the assessment, summarized below, tunneling options were eliminated from further detailed study. (*Phoenix South Mountain Park/Preserve and Traditional Cultural Property Avoidance, Ridge Bridge – Tunnel Analysis Memorandum* [2009], see sidebar on page 3-2)

Safety and Constructibility – Tunnel options would create undesirable safety issues. Emergencies would result in complex response planning for traffic control, fire detection, ventilation and exhaust, and fire safety systems. There are security concerns with tunnels on urban freeways being considered potential terrorist targets (American Association of State and Highway Transportation Officials [AASHTO] 2003). It is possible that the entire segment of the proposed action would have signs installed warning that transportation of hazardous cargo is prohibited. (For more information on the transport of hazardous materials, see page 4-166.)



Note: graphics are not to scale

Tunneling under the South Mountains (continued)

The proposed freeway is being constructed with eight lanes. In an ideal situation, all lanes of traffic moving in one direction would be in one tunnel (see “ideal,” in the top graphic). For the proposed freeway’s eight lanes, this would result in two tunnels, each approximately 92 feet wide. The four-lane tunnels would not be possible with current construction technology. A review of tunnels constructed in the United States and around the world indicates that 80 feet is the maximum practicable limit for tunnel excavation under ideal conditions, about 12 feet narrower than would be necessary for the ideal option.

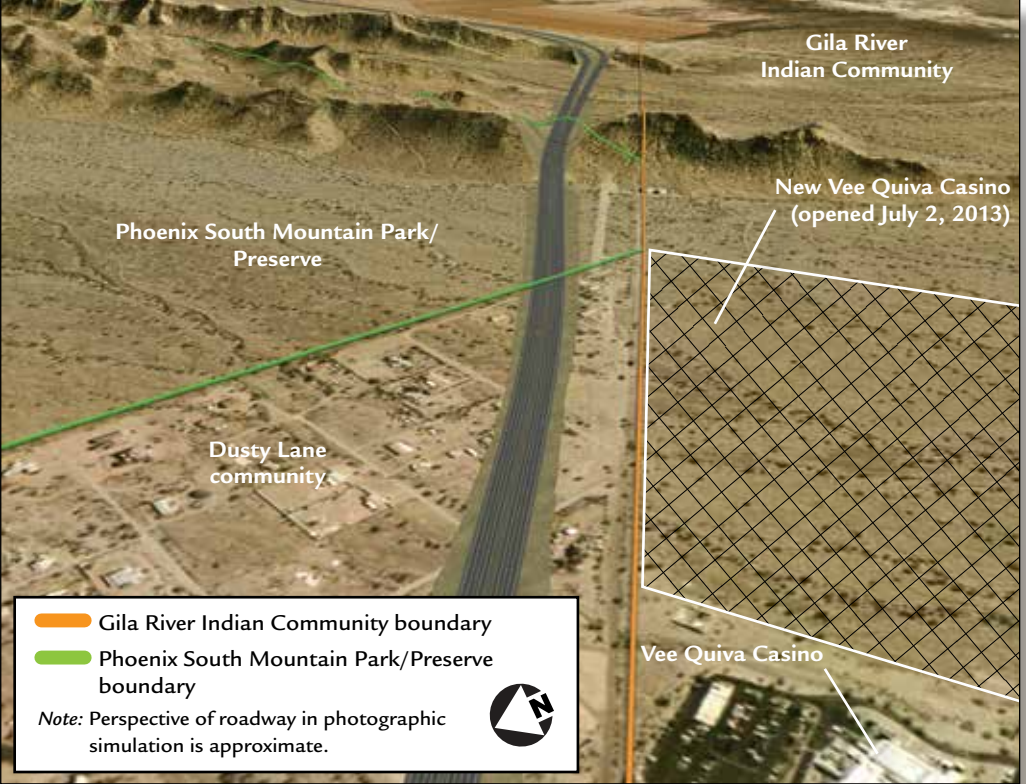
The only option that appears constructible using current technology would use three or four tunnels, splitting HOV traffic into a single tunnel or individual tunnels (see “constructible” options A and B in the graphic to the left). The three-lane tunnels would require an 80-foot width, at the limit of constructibility for any known existing tunnels in the United States. Because of the variable nature of site-specific geology (including dangers that could arise from encountering fractured rock), it is not possible at this time to determine specific dimensions of a maximum feasible tunnel width.

Both ADOT and FHWA believe that an 80-foot tunnel option would result in unacceptable safety concerns, with diverging traffic and increased constructibility challenges.

(As a side note, readers may have observed that the I-10 tunnel through downtown Phoenix accommodates more than five lanes in each direction. However, it is not actually a tunnel. Instead, it is an open cut, capped with a “deck” [a city park] supported by load-bearing concrete walls. This is why the structure is called the “Deck Park Tunnel.”)

Impacts – The desired effects from tunnel options—avoidance of the conversion of parkland to a transportation use, intrusion of an intensive use into a passive setting, reduced access, reduced impact on a traditional cultural property, and loss of habitat—would not be fully achieved. The tunnel options would have less visual, noise level, and habitat acreage impacts than would the open cut design of the proposed action; total avoidance of such impacts, however, would not be possible. Each tunnel option would require entrances, or portals, that would necessitate ridgeline excavation and subsequent scarring as high as 75 feet. (See the photo simulation on the right, above.)

ADOT would evaluate treatment of any newly exposed rock faces for suitability for application of standard treatments. These might include recessing the face of



The illustration on the left depicts changes to the ridgelines resulting from the proposed action. The illustration on the right depicts potential changes to the ridgelines from tunneling (for more information related to the new Vee Quiva Casino, see Figure 5-9 on page 5-16).

the tunnel portals to minimize their apparent breadth; incorporating rock crags characteristic of the adjacent natural rock features; rounding and blending newly cut faces to minimize existing contours and highlight natural formations; adjusting or warping slopes to flow into each other or transition with the natural ground surface with minimally noticeable breaks; shaping, sloping, and fracturing exposed rock formations to the extent practicable and feasible, depending on geotechnical and constructibility reviews; using shotcrete that matches the colors and textures of adjacent rocks; or staining cut faces to match the surrounding rock colors.

Additionally, necessary bridge structures, embankments for approaches, rockfall protection systems above the portals, ventilation equipment locations, maintenance facilities, and access roads would further alter the natural setting in the parkland. Therefore, avoidance of the impacts outlined would not be fully achieved using the tunnel options.

Maintenance – Tunnel options would result in higher long-term operational and maintenance costs than a typical

freeway. Costs would include full-time personnel for operation and maintenance of ventilation equipment and drainage structures, rockfall protection maintenance at the portals, and tunnel rehabilitation. Annually, these costs are estimated to range from \$1.5 million to \$2 million. Further, regular maintenance would require tunnel closures lasting a weekend and would require undesirable traffic detour planning and routing.

Construction Cost – Preliminary construction costs for the tunnel options range from approximately \$215 million to \$1.9 billion, depending on length and excavation (see section, *Tunnel Alternatives*, beginning on page 5-18). The estimate for the same segment of the proposed action (open cut) is approximately \$41 million. Considering that current technology does not allow for construction of tunnels that would meet the ideal characteristics and that tunnel options would not fully achieve the desired outcomes, ADOT and FHWA have determined the additional costs presented by tunnel options would not be warranted and, therefore, not justified. ADOT and FHWA would implement mitigation measures as outlined

beginning on page 5-23 to reduce impacts from the proposed action on the South Mountains.

For the reasons stated, the tunnel options were eliminated from further study. The study of tunnel options through the South Mountains is not new. In the late 1980s, similar concerns regarding impacts on the South Mountains were expressed by the public, and tunnel options were studied as part of the design process undertaken in 1988 (ADOT 1988b). Reasons to eliminate the tunnel options from further study at that time are consistent with the conclusions reached in this study and presented in this document.

The assessment and its conclusions also have direct applicability to other federal regulations guiding the analysis of alternatives in the NEPA process, specifically to the evaluation of alternatives as outlined under procedures established to protect resources afforded protection under Section 4(f) of the Department of Transportation Act. [See Chapter 5, *Section 4(f) Evaluation*, for further discussion regarding the evaluation.]

Drainage design options

Drainage design for the depressed profile option included a number of concepts that have been implemented along freeways in the Phoenix area. The photos below provide examples.



Narrow parallel retention basin



Channel over freeway



Off-site retention basins



Underground storage cells

► **Surrounding environment** – For example, public comments suggest a depressed freeway would be more effective than an at-grade rolling profile in reducing impacts on adjacent land uses that may be sensitive to the freeway’s effects. It cannot be assumed, however, that a depressed freeway would reduce all noise and visual impacts. Noise walls, which could affect visual quality, would still be necessary on a depressed freeway.

Drainage served as the primary design constraint for the Pecos Road segment of the E1 Alternative. Runoff from the South Mountains follows mostly natural drainage patterns as it flows to the southwest through Ahwatukee Foothills Village, across Pecos Road, and onto Community land. The Community has documented concerns relating to the quantity, quality, and location of drainage released onto its land. These concerns have controlled drainage design on other Regional Freeway and Highway System segments such as SR 202L (Santan Freeway).

ADOT and FHWA employed these factors in considering a depressed profile option for the proposed freeway. Assessments were performed to determine constructibility and effectiveness in avoiding or reducing impacts and to evaluate whether a depressed profile would generate other desired or undesired outcomes. Based on the results of these assessments, further design options were developed and refined in attempts to reduce impacts on the adjacent community. The modifications incorporated alternative drainage designs, use of retaining walls, and other features to reduce R/W requirements.

Four drainage concepts were developed for a depressed profile through Ahwatukee Foothills Village and its surroundings: the use of linear channels, underground storage, off-site detention basins, and channels (see sidebar on this page).

To summarize the results presented in the ADOT technical memorandum, *E1 Alternative – Profile Variations along Pecos Road* (2009), see sidebar on page 3-2, the depressed freeway options would create:

► **Drainage design complexities** – The existing drainage facilities adjacent to and passing under

Pecos Road are designed to accommodate a 10-year storm. According to ADOT guidelines, the drainage facilities for on-site flow (water falling on the proposed freeway) must accommodate a 10-year storm and facilities for off-site flow (water passing under the proposed freeway from upstream areas) must accommodate, minimally, a 50-year storm. It is assumed that outflow onto Community land would be maintained at the current flow and location. Using a rolling profile for the roadway, maintenance of the existing flow would need extension of the existing drainage structures and construction of small drainage basins at regular intervals.

► With a depressed freeway section, drainage facilities for both the on- and off-site flows would, at a minimum, have to accommodate a 50-year storm for driver safety. The depressed freeway section would sever the existing drainageways, resulting in the need to develop new and potentially larger facilities, including four to six pump stations. Because any drainage design option associated with a depressed freeway option would not be allowed to exceed existing outflows, more water would need to be stored upstream, resulting in the need to develop large drainage basins and, therefore, acquire more R/W. Also, redistributing the water to its original drainage pattern would be more difficult once it has been collected into a basin.

► **Greater R/W needs than the at-grade rolling profile under study** – Approximately 150 additional acres would be needed when compared with the at-grade rolling profile under study.

► **More residential displacements** – As a result of the increased R/W needed, between 152 and 326 more residences would be displaced, depending on the drainage design option considered when compared with the at-grade rolling profile.

► **Increased costs** – The total construction costs for the depressed freeway options would be nearly 50 percent higher when compared with the at-grade, rolling profile under study for this area of the proposed action. Costs would increase from \$761 million for the at-grade, rolling profile option to \$1.23 billion to \$1.26 billion for the depressed freeway options.

The majority of the additional \$469 million to \$499 million is for R/W, approximately 90 percent, while the remaining 10 percent is for construction.

► **Impacts on Ahwatukee Foothills Village** – The public generally perceives that a depressed freeway would reduce and/or eliminate impacts on visual resources and freeway-related noise. Visual and noise-level impacts from operation of the proposed E1 Alternative would, however, still occur and would require mitigation, as would be the case for the at-grade rolling profile.

For these reasons, the depressed freeway options were not carried forward for further study. Instead, the rolling profile was carried forward. Maintaining the existing flows onto Community land with a rolling profile would require extension of the existing drainage structures and the construction of small drainage basins at regular intervals.

Utility Easement Options

Another option suggested to reduce impacts on Ahwatukee Foothills Village would be to locate the Pecos Road Alignment on the utility easement immediately south of Pecos Road. The concept would be to construct the freeway on the existing utility easement, as close to the Community boundary as possible, thereby providing additional separation from the neighborhoods north of Pecos Road in Ahwatukee Foothills Village. To achieve this design, the power lines would be relocated from the southern side of the proposed freeway to the northern side of the proposed freeway in the western portion of Ahwatukee Foothills Village, beginning west of 25th Avenue. The power lines would remain north of the freeway until approximately 32nd Street, where they would cross back to the southern side.

An assessment of the option revealed:

- Relocation of the power lines would require acquisition of additional R/W for a utility easement to replace the existing easement. This would result in essentially the same amount of R/W acquisition as would be required with the at-grade, rolling profile under study.
- This concept would locate overhead power lines immediately adjacent to residential neighborhoods,

an action that could be perceived as a negative impact.

- Relocation of the 500 kilovolt power lines would cost approximately \$2 million per mile, or \$15 million for the length considered for relocation, not including R/W costs and prior rights issues (see sidebar on this page).
- Indications from the utility companies are that the lines could not be relocated underground because of the ancillary equipment required (e.g., cooling facilities) and associated costs.

For these reasons, the utility easement option was not carried forward for further study.

Design Adjustments (Fourth Tier)

The action alternatives advanced from the Third-tier screening process were subjected to intensive engineering, cost, environmental, economic, and social analyses, and these action alternatives (along with the No-Action Alternative) were presented to the public for comment at numerous meetings and open houses between 2005 and 2009 (see Chapter 6, *Comments and Coordination*). During this period, an economic downturn gripped the nation, including Arizona. According to the draft *Annual Report on the Status of the Implementation of Proposition 400* (MAG 2009c), the half-cent sales tax approved through Proposition 400 has been the major funding source for the RTP and provided over half its revenues. Because sales tax receipts have declined (and are projected to continue declining), fiscal year 2008 (the MAG fiscal year begins July 1 and ends June 30) receipts from the one-half cent sales tax were 3.2 percent lower than in fiscal year 2007 (MAG 2009c). This period marked the first decline in the history of the one-half cent sales tax since its inception in 1985. The decline continued with fiscal year 2009 receipts, 13.6 percent lower than fiscal year 2008 receipts. Adding to transportation budget shortfalls, other revenues provided for the RTP have declined and are expected to continue to decline.

In response, MAG began evaluating methods of cutting project costs while still delivering the major

RTP elements. The effort included methods to address public concerns (acquisitions of homes, etc.) and reduce costs, R/W needs, and other impacts for this project. The effort, a Fourth-tier screening process, resulted in considering other alternatives to a freeway, reducing or “constraining” the freeway and its R/W, and making alignment adjustments. Each of these cost-cutting measures is further discussed below.

Alternatives to a Freeway

To reduce costs and impacts of the proposed freeway, the project team considered use of what is termed the Arizona Parkway as an alternative to an access-controlled freeway (see sidebar on this page). The parkway is a nonfreeway, restricted-access facility having greater capacity than major urban arterial streets. The parkway alternative, by design, would provide additional travel capacity without needing full grade separations at intersections with arterial cross streets. In the best-case scenario, average daily traffic (ADT) on the parkway would be approximately 105,000 vehicles per day (vpd), well below the ADT on the proposed freeway, which would range from 117,000 to 190,000 vpd. As a result, the Arizona Parkway would lack sufficient capacity to meet projected travel demand. The Arizona Parkway would not adequately address the projected transportation system capacity deficiency and would not remove a sufficient amount of traffic from the arterial street network and, therefore, would not meet the proposed project’s stated purpose and need. For these reasons, the Arizona Parkway was eliminated from further consideration.

This analysis reinforced that a freeway corridor was the appropriate infrastructure facility; means to reduce the R/W acquisition needs and other costs associated with a freeway facility were reviewed by MAG.

Constrained R/W Eight-lane Freeway

To continue in its efforts to undertake cost-cutting measures, MAG, in association with ADOT, examined design refinements that would reduce the R/W width proposed for the freeway without jeopardizing the ability to meet the purpose and need established for the proposed project. The action alternatives advanced

from the Third-tier screening process were designed with a freeway cross section that provided three general purpose lanes in each direction and sufficient R/W to add an HOV lane and a general purpose lane in each direction in the median in the future when warranted by travel demand. In addition, the proposed freeway was designed to have side slopes based on ADOT design guidelines, thereby avoiding the need for retaining walls. The Fourth-tier evaluation included an alternative design with a reduced number of lanes (three general purpose lanes and one HOV lane in each direction) and a constrained R/W (see text box on the next page regarding constrained and unconstrained R/W).

The analysis assumed that while the freeway with a constrained R/W section would not preclude future expansion of the freeway, it would make any future widening much more expensive and considerably more disruptive to freeway operations when compared with the unconstrained cross section. Examples of these issues include:

- Widening the freeway through the South Mountains’ ridges would be highly challenging because the additional lanes could encroach on the rockfall containment ditches and could need additional excavation of the mountain ridges.
- Reconstructing on- and off-ramps while widening the freeway to the outside could be disruptive to motorists because the ramps may need to be closed for an extended period of time.
- Removing and reconstructing noise barriers and retaining walls to accommodate additional freeway lanes would be very costly.

The MAG regional travel demand model was used to compare the operational performance of the unconstrained R/W section (four general purpose lanes and one HOV lane in each direction [ten-lane freeway]) and constrained R/W section (three general purpose lanes and one HOV lane in each direction [eight-lane freeway]).

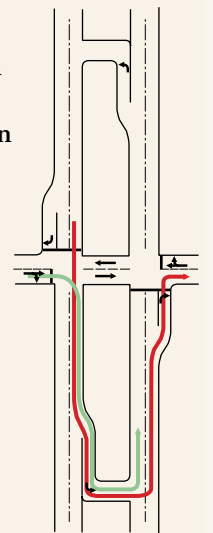
The analysis was conducted to determine whether the reduced number of lanes in the constrained R/W freeway would still meet the need of the proposed freeway.

Utilities and prior rights

The term *prior rights*, as used in this FEIS, refers to a situation involving a utility company that has facilities located on private easements later encompassed by the State’s R/W. In this situation, the utility is given a choice of relocating its facilities onto a public R/W or of acquiring a new private easement and relocating onto it. Either would be at ADOT’s expense.

“Arizona Parkway” concept

The Arizona Parkway adds capacity by eliminating left-turn movements at intersections and accommodating such turns elsewhere—a design approach commonly referred to as the Michigan left turn, or indirect left turn. In a Michigan left-turn intersection, a U-turn break in the median on the departure side of the intersection accommodates left-turn movements. Traffic signals can be used at high-volume intersections to control congestion at these U-turn breaks. Key advantages of this parkway configuration over a typical urban arterial street come from eliminating left turns traditionally located at intersections, thereby providing greater capacity, less delay and idling, and less potential for collisions at intersections. For more information, see <www.bqaz.org/azparkway/index.asp>.



Constrained and Unconstrained Rights-of-way

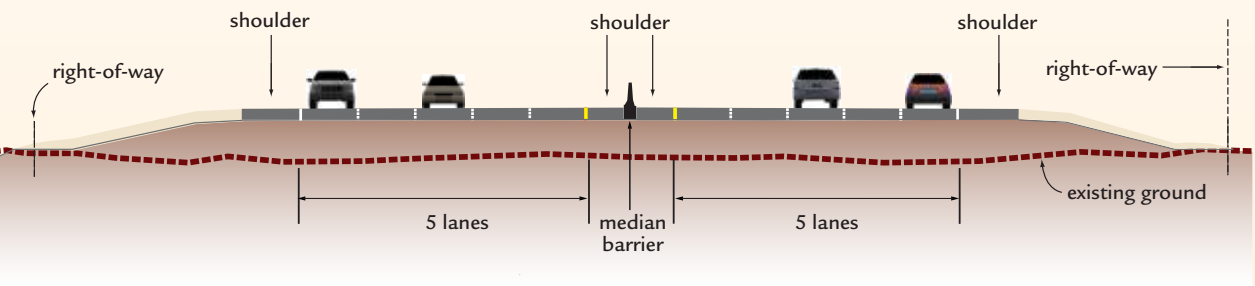
Many of the recently completed segments of the Regional Freeway and Highway System have been constructed with sufficient R/W for three general purpose lanes in each direction and with the flexibility to accommodate an additional HOV lane in the median without having to acquire more R/W. Any additional general purpose lanes would require widening to the outside, which could trigger acquisition of more R/W and reconstruction of traffic interchanges along the freeway alignment.

Learning from the benefits and challenges of this design, the South Mountain Freeway typical section (number of lanes and R/W) initially considered in the FEIS would have allowed for widening to

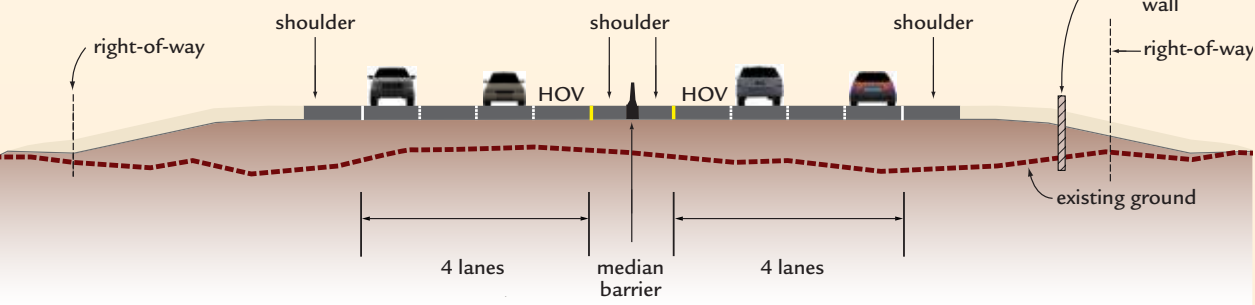
accommodate one general purpose lane and one HOV lane in the median, thus reducing future costs and community impacts associated with additional lanes. This typical section (a ten-lane freeway) would also have used desirable side slopes according to ADOT design guidelines in lieu of retaining walls.

In 2009, to reduce initial project costs and community impacts, the South Mountain Freeway typical section was reconfigured to three general purpose lanes and one HOV lane in each direction (an eight-lane freeway). In addition, the needed R/W for this section was further reduced by using retaining walls instead of side slopes where additional R/W cost savings would be realized.

Unconstrained Right-of-way



Constrained Right-of-way



The methods used for this analysis were identical to those presented in *Responsiveness of the Proposed Freeway to Purpose and Need Criteria*, beginning on page 3-27. It is important to note that with the reduction in number of lanes, the relative capacity of the freeway would be reduced by 20 percent. This loss in capacity would have its greatest effect during the peak commuting periods of the day, when the freeway would be operating at capacity. During off-peak times, the severity of the

impact would be less because the demand would be less than the capacity of an eight-lane freeway. Although the analysis showed that there would be traffic-related consequences of reducing the number of lanes of the proposed freeway, the eight-lane freeway would still meet the purpose and need criteria, just not as well as the ten-lane freeway. The summarized results follow:

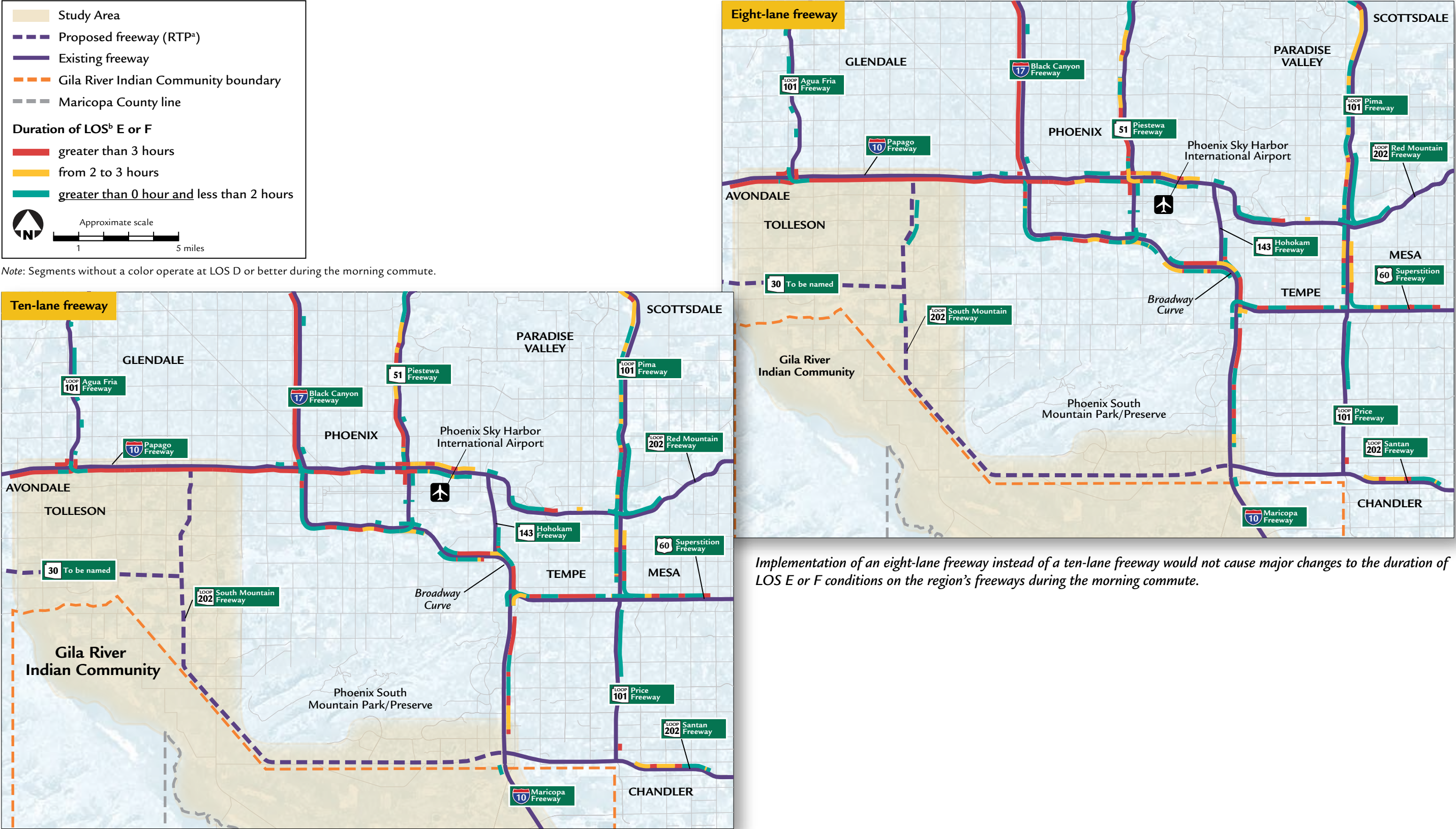
- The distribution of traffic between arterial streets and freeways (as shown in the cut-line analysis) would be about the same between the eight- and ten-lane freeways. This shows that there would be no reduction in the number of trips, just a redistribution of trips to fill the capacity of the freeway and arterial street network.
- In 2035, the daily traffic volume on the proposed action would decrease by 2,000 to 13,000 vpd with the eight-lane freeway when compared with a ten-lane freeway. This traffic would be spread across the region's arterial street and freeway networks.
- Daily traffic volumes on other freeways in the region would vary by less than 2 percent (plus or minus) between the eight- and ten-lane freeways. This minimal change is explained by the fact that these other freeways would be operating at capacity; therefore, with the eight-lane freeway, motorists would likely shift to driving on arterial streets to avoid congestion on the region's freeways.
- Daily traffic volumes on arterial streets in the region would vary by up to 10 percent (plus or minus depending on location) between the eight- and ten-lane freeways.
- According to the cut-line analysis, the ten-lane freeway would accommodate 84 percent of the unmet demand, while the eight-lane freeway would accommodate 80 percent. Therefore, the ten-lane freeway would meet 4 percentage points more of the unmet demand than would the eight-lane freeway. To match the capacity of the ten-lane freeway, two additional freeway lanes or six additional arterial street lanes would need to be constructed along with the eight-lane freeway.
- The differences in the duration of level of service (LOS) E or F on the region's freeways (not including the proposed action) are depicted in

Figures 3-9 and 3-10 for the morning and evening commute, respectively. Although some declines in operations would occur, no substantial changes in the operations of the region's freeways would be caused by the reduction in the number of lanes on the proposed freeway. Similar to the observation regarding traffic volumes on the region's freeways, with the eight-lane freeway, motorists would likely shift to driving on arterial streets to avoid congestion on the region's freeways, which would be operating at capacity.

- At eight lanes, the proposed freeway would have areas of morning and evening LOS E or F for less than 2 hours (see Figure 3-10); these areas would have 0 hour of congestion with the ten-lane freeway. This additional congestion would result from reducing the number of lanes on the proposed freeway.
- The constrained R/W eight-lane freeway (see the section, *Alignment Adjustments*, beginning on page 3-23) would cost about \$200 million less than the ten-lane freeway (\$50 million less for construction and \$150 million less for R/W). Most of the cost savings associated with the eight-lane freeway would be realized by building retaining walls (rather than slopes that take up a larger area) in areas where land is more expensive, allowing ADOT to avoid higher R/W acquisition costs. Reducing the number of lanes from ten to eight would narrow the freeway footprint by 24 feet.

From this analysis, it was concluded that the constrained R/W freeway (eight-lane freeway) would address the purpose and need criteria as described in Chapter 1, although the unconstrained R/W freeway (ten-lane freeway) would have better performance (less congestion) and would be easier and less expensive to expand in the future, if warranted by traffic demand. The eight-lane freeway, however, would sufficiently address capacity deficiency, would shift an appropriate amount of traffic from the arterial street network to the freeway network, would increase network capacity, and would do so with less R/W acquisition. For example, a ten-lane E1 Alternative would displace 317 residences,

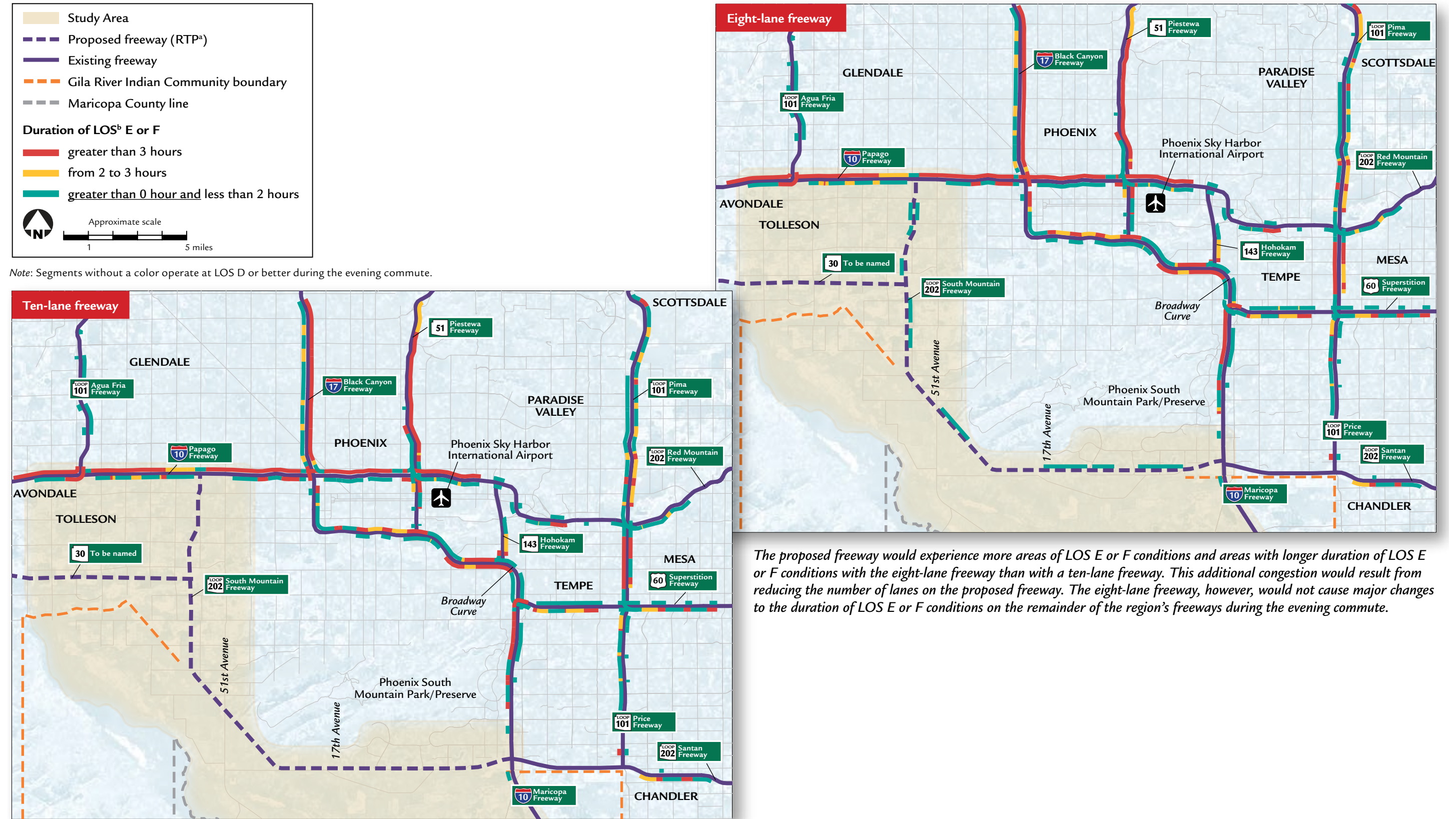
Figure 3-9 Duration of Level of Service E or F on Eight-lane and Ten-lane Freeways, Morning Commute, 2035



^a Regional Transportation Plan ^b level of service

Source: Maricopa Association of Governments, 2013c; extrapolated analysis

Figure 3-10 Duration of Level of Service E or F on Eight-lane and Ten-lane Freeways, Evening Commute, 2035



The proposed freeway would experience more areas of LOS E or F conditions and areas with longer duration of LOS E or F conditions with the eight-lane freeway than with a ten-lane freeway. This additional congestion would result from reducing the number of lanes on the proposed freeway. The eight-lane freeway, however, would not cause major changes to the duration of LOS E or F conditions on the remainder of the region's freeways during the evening commute.

but an eight-lane E1 Alternative would displace 138 residences—a 56 percent reduction. Because the eight-lane freeway would meet the proposed project’s purpose and need and would do so with lower costs, less R/W acquisition, and fewer impacts than the ten-lane freeway, it was carried forward for further consideration. Accordingly, the ten-lane freeway was eliminated from further consideration.

Alignment Adjustments

In 2009, MAG suggested that a portion of the W55 Alternative (advanced from the Third-tier screening) could be shifted west onto 59th Avenue to take advantage of R/W owned by the City of Phoenix and to reduce cost and business displacements. Further analysis was conducted related to alignment, traffic operations, construction impacts, and environmental considerations (*W59 Alternative Environmental and Engineering Overview* [2010], see sidebar on page 3-2). As shown in Figure 3-7, this shifted alignment (called the W59 Alternative) would connect to I-10 (Papago Freeway) at 59th Avenue and offer the following advantages and disadvantages:

- would enable better I-10 traffic performance than would be achievable with the W55 Alternative
- would offer certain design advantages over the W55 Alternative such as perpendicular crossings of the canal, railroad, and I-10
- would be preferred from a security perspective because it would be farther from the petroleum storage facilities at 51st Avenue and Van Buren Street
- would not reconstruct the 51st Avenue Bridge at I-10
- would require the relocation of fewer businesses
- would require the relocation of utilities along 59th Avenue
- would cause increased disruption of traffic during construction along 59th Avenue
- would eliminate direct access from I-10 to 59th Avenue and vice versa (indirect access would be provided by a system of access roads connecting to 51st and 67th avenues)
- would require the relocation of more single-family residences and two apartment complexes

In developing the W59 Alternative, two location options and two drainage channel configuration options were considered between Van Buren Street and Lower Buckeye Road. The two location options considered a W59 Alternative to the west of 59th Avenue and to the east of 59th Avenue. The two drainage channel configuration options both needed the drainage channel to be located on the eastern side of the W59 Alternative to capture the surface water generally flowing from the east. However, the channel could be located either between the freeway and frontage road or east of the frontage road. Ultimately, through analysis of projected impacts, ADOT, MAG, and the City of Phoenix determined that the best location of a drainage channel for the W59 Alternative is west of 59th Avenue between Van Buren Street and Lower Buckeye Road and that the drainage channel would be located between the freeway and the frontage road. The other options were eliminated from further study.

Alignment Description

The W59 Alternative would follow the W55 Alternative alignment south of Lower Buckeye Road. North of Lower Buckeye Road, the W59 Alternative would remain parallel and adjacent to 59th Avenue on its western side. The W59 Alternative would use a portion of the existing 59th Avenue R/W owned by the City of Phoenix. In this area, approximately between Van Buren Street and the Roosevelt Irrigation District (RID) canal, existing 59th Avenue traffic would be carried on either side of the proposed freeway on frontage roads (see sidebar on this page). Southbound 59th Avenue traffic would be placed on a frontage road on the western side of the proposed freeway, and northbound 59th Avenue traffic would be located on a frontage road on the eastern side of the freeway. Access would be provided to and from 59th Avenue for the properties adjacent to the frontage roads. The frontage roads and the freeway would be separated by walls, with on- and off-ramps providing movement between the facilities, at approximately every mile. The frontage roads would be two lanes wide on each side of the W59 Alternative. The W59 Alternative would connect to I-10 (Papago Freeway) with a system traffic interchange. Connecting the proposed freeway to I-10 (Papago Freeway) would result in modifications to the existing service traffic interchanges (see Figure 3-29 on page 3-53).

Operational Comparison of W55 and W59 Alternatives

The W55 Alternative included service traffic interchanges that would have been close to the existing intersections of 59th Avenue with Buckeye Road and with Van Buren Street—leading to an undesirable situation along Buckeye Road and Van Buren Street where three major signalized intersections would have been located within a ¼-mile distance. With the W59 Alternative, 59th Avenue would be incorporated into the freeway as a frontage road system. Therefore, there would be only two signals at each arterial street, and they would be coordinated to handle 59th Avenue and I-10 (Papago Freeway) ramp traffic.

According to a traffic sensitivity analysis using 2035 traffic projections, the intersections associated with the W55 Alternative would reach LOS F with lower traffic volumes than would the intersections associated with the W59 Alternative. This observation is consistent for both the morning and evening commutes as well as at both the Buckeye Road and Van Buren Street intersections. In summary, the W59 Alternative frontage road system would handle higher traffic volumes better than would the W55 Alternative with closely spaced intersections.

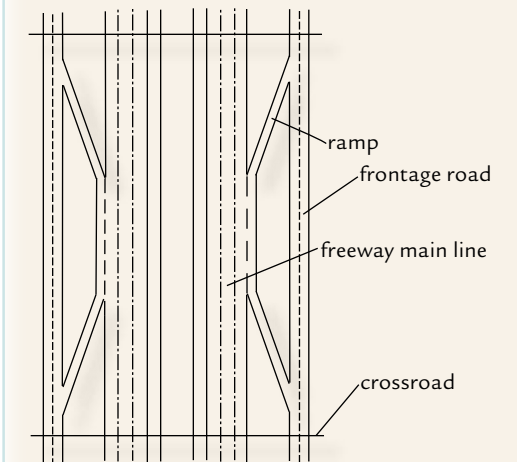
A microsimulation model was used to evaluate traffic conditions on I-10 at the connections with the W55 and W59 Alternatives. This model provides numerous measures of effectiveness for evaluating freeway-to-freeway connections. No single metric tells the entire story of the operational characteristics of the model. In this case, delay per vehicle and average travel time were chosen as measures of effectiveness for the analysis of the W55 and W59 Alternatives because they were distinguishing characteristics between the two alternatives.

The model showed that I-10 would function better with the W59 Alternative. This is because the W59 Alternative would have a more compressed system traffic interchange with I-10 that would provide better spacing between adjacent on- and off-ramps for the 67th Avenue and 51st Avenue traffic interchanges. Conversely, the W55 Alternative would have additional on- and off-ramps that would cause more issues with traffic weaving

W59 Alternative frontage road section

The proposed W59 Alternative would use a portion of the 59th Avenue R/W and convert 59th Avenue into one-way frontage roads on each side of the freeway (see graphic below). At no cost to the project, the 59th Avenue R/W (similar to any local or county street R/W) can be taken into ADOT’s R/W system through a resolution by the State Transportation Board (STB).

The frontage roads along 59th Avenue would allow direct access from adjacent properties. Examples of similar frontage road systems in the region include SR 101L (Price Freeway) between U.S. Route 60 (US 60) and SR 202L (Santan Freeway), and I-17 between McDowell Road and Glendale Avenue (shown in the photo below).



Source: Arizona Department of Transportation, 2010a